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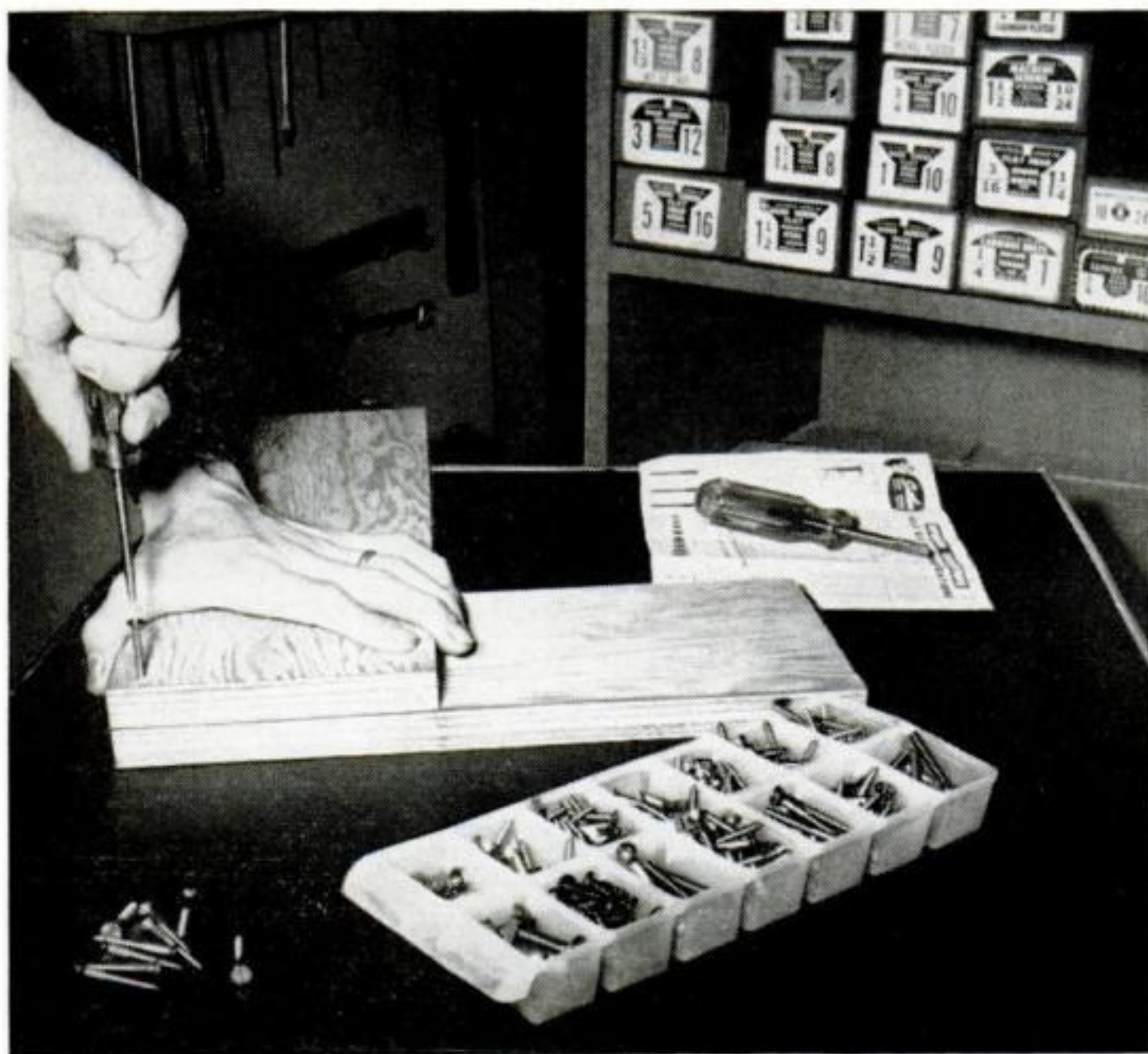
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Popular Science Monthly

June, 1957



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What size will you need? How much will it cost? PS answers all your questions. With complete specs, of course

AUTOMOBILES

What You Get in Foreign Economy Cars • [59](#)

How Did Your Car Get Its Name? • 113

Those Deadly Highway Ghosts • 119

Getting Your Car in Shape for a Trip • 138

[How to Take Care of a '57 Ford • 179](#)

WORLD OF SCIENCE AND INDUSTRY

[History's Most Fateful Weather Forecast • 72](#)

[Look What They're Doing to Batteries • 77](#)

Who Owns Outer Space? • 118

New Missile Strikes Like Rattlesnake • 122

New Life Rafts Defy Sea's Terrors • 128

PS REPORTS TO HOMEOWNERS

How to Buy a Room Air Conditioner • [81](#)

The Facts About Swimming Pools • 155

PICTURE NEWS

[Fastest Bomber Hooks a Ride • 94](#)

[Air-Conditioned Walk Beats the Heat • 96](#)

[Paratrooper Takes Movies as He Falls • 100](#)

[New Midsection "Stretches" Tanker • 102](#)

[Helicopter Tows 3,000-Ton Ship • 104](#)

[Light Pours into "Cogwheel" Library • 105](#)

[Skyhooks Raise Roof on New Factory • 108](#)

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SPECIAL FEATURES

How to Climb a Mountain from Inside • 66

Success Without a College Degree • 86

Bouncing Truth Across Iron Curtain • 91

Gus Rescues a Rival Mechanic • 132

Would Your Home Sell for a Profit? • 143

Hi-Fi Is Better Than Live Music! • 151



Any opening in the earth may mean adventure—and danger—to this cave explorer

FOR HOME AND SHOP

Five Ways to Curb a Driveway • 148

Fix-It File: Venetian Blinds • 153

Why TV Sets Produce Squawks • 161

What to Do About a Dunked Outboard • 165

The Saw That Cuts Its Starting Hole • 168

The Right Way to Set a Fence Post • 176

How I Made a Modern Boom Lamp • 188

Well Water Air-Conditions Our Home • 202



Good fence posts make a good fence. Here's how to set them

WHAT'S NEW IN . . .

Keeping the Home Shipshape • 14

Ideas from the Inventors • 115

Aids to Modern Living • 126

Hints from the Model Garage • 136

Car Accessories • 142

Handyman Products • 147

Tools for Your Shop • 173

EVERY MONTH . . .

PS Readers Talk Back • 4

Prize Projects by PS Readers • 16

I'd Like to See Them Make • 18

You Ought to Know • 21

Wordless Workshop • 174

PS Shop Notebook • 186

Short Cuts and Tips • 190

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EDITORIAL OFFICES:

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ADVERTISING OFFICES:

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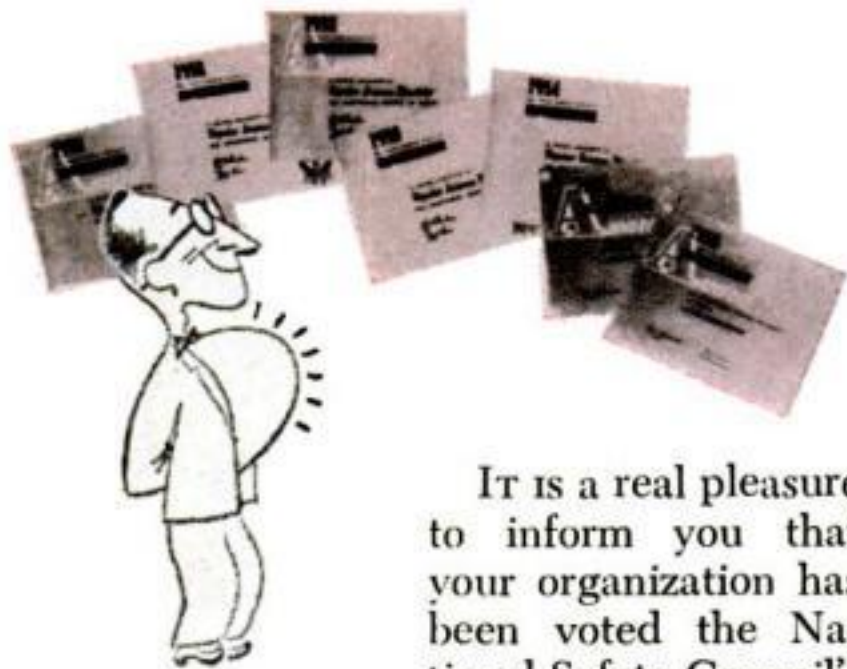
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TALK BACK

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It is a real pleasure to inform you that your organization has been voted the National Safety Council's

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The award is designed to allow us to express in tangible form our appreciation for exceptional service to safety. . . There is another, less tangible, result of your safety efforts—the knowledge that you have helped prevent many accidents.

NED H. DEARBORN, President,
National Safety Council, Chicago

For the seventh time, PS is pleased to accept this honor.

Straight Talk to Parents

I READ with interest D. R. Lindsay's article "Can Your Youngster Get into College?" [April]. May we have permission to copy the article and send it out to our boys' parents?

BENEDICT RICH, Headmaster,
Midland School, Los Olivos, Calif.

. . . I am writing to ask if I may have permission to reprint or duplicate the article by John Kord Lagemann [March, "How to Be a Good Father to a Gifted Child"]. I would like to send it to the homes of the gifted children enrolled in our schools.

RICHMOND BARBOUR, Director of Guidance,
San Diego (Calif.) City Schools

Permission granted.

. . . Can you furnish additional copies of the article by John Kord Lagemann? We are organizing a community study group

for the gifted child and would appreciate having 25 copies of the article.

MRS. EVELYN S. THIRKILL,
Class A School District No. 25,
Pocatello, Idaho

. . . I read with great enjoyment the "Gifted Child" article. Is it possible to obtain reprints?

FRANK A. RIZZO, Visiting Teacher
Department of Education
Niagara Falls, N. Y.

A limited number of reprints of the Gifted Child article are available to those who send a stamped, self-addressed envelope with their requests.

A Fan Letter from the Antarctic

LAST summer you very kindly donated recent issues of PS to Operation Deep Freeze II for use in the Antarctic.

It is my pleasure to report to you from



Little America V that the magazines are being read avidly, and will continue to be read throughout the long winter night, which will soon commence. All hands join me in saying a hearty thank you.

JOHN E. ZOLLER, Chaplain
U. S. Navy, Little America V

Gets 70,000 Out of His Tires

I HAVE been able to get 70,000 and up from standard tires ["How to Double Your Tire Mileage," March] and have at present one tire carcass in use on a '50 Dodge that was retreaded at 70,000 and now has 96,000 on it.

The last car issued to me (I am a retired Immigration officer) in Feb., 1942, was a Ford with 4-ply tires. I drove it continuously for 72,500 miles. My personal car, the Dodge mentioned above, has pulled a

WHAT HAPPENS WHEN A MAN DECIDES TO DO SOMETHING! ABOUT HIS FUTURE!

The proven rule of "learn more to earn more" took M.E.F. (name on request) from a position of truck driver to that of an accounting executive in sixteen months. Listen to what M.E.F. says:

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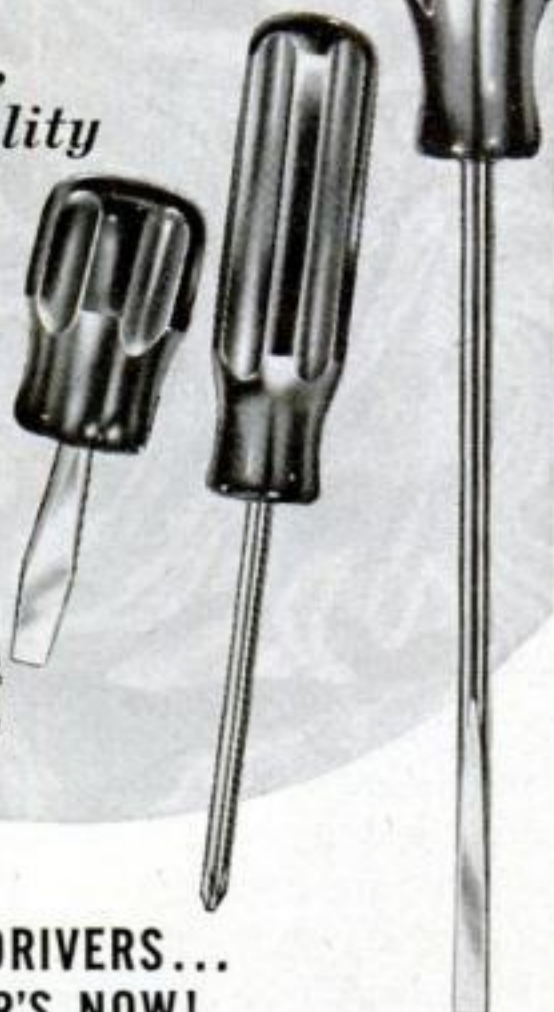
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FRANKLIN DAVIS, Santa Ana, Calif.

Protest from a Young Driver

I HAVE been a reader of PS for several years now and think it is a very informative magazine.

But you have some very disgusting articles occasionally, such as "Who Are America's Worst Drivers?" [Jan.]. It just isn't fair. . . Some of your "older, more ex-



perienced drivers" cause the accidents involving young people.

A/2c JOHN M. THOMAS, Loring AFB, Maine

Sad but true. Our article, however, dealt with overall statistics—not individual cases. And, sadder but true, unmarried male drivers under age 25 have more accidents per capita than any other class.

Outboard Horsepower Ratings

AS MANUFACTURERS of Mercury outboard motors we would like to point out a few errors in the article by David R. Lindsay [April]:

1. Horsepower ratings of the 1940s were generally optimistic rather than conservative. Manufacturers' association rating procedure once permitted the use of laboratory engines for official test purposes and even allowed a choice of "flash" readings as the rated horsepower. A "flash" reading on a cold engine will generally be higher than on an engine running for some time—as would be the case in customer use.

We do *not* rate the Mercury engine at 5,800 r.p.m., the latter figure being the recommended maximum at which the engine should be run in day-in, day-out use. The speeds at which our engines develop their rated horsepowers are well below this. Atmospheric rating corrections are made according to the Test Code of the Society of Automotive Engineers.

2. Mr. Lindsay's statement that most two-cycle engines can be run in either direction

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"Before enrolling I was a laborer. Now have good service job, profitable spare time business." *E. M. Dudek, Chicago, Ill.*



"I have a job working on Radar. Also do spare time TV-Radio servicing." *F. Zawake, Scranton Pa.*

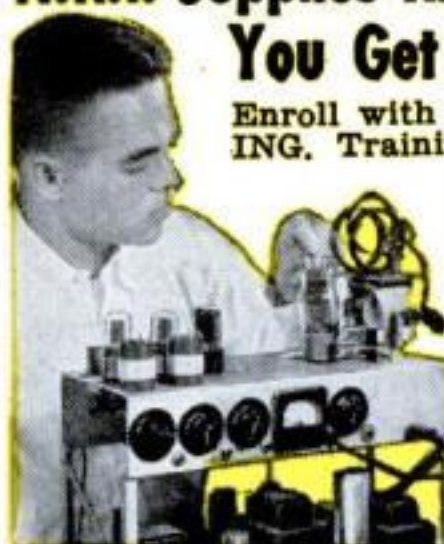
Television-Radio

Bigger than ever and still growing fast. That's why Television-Radio has special appeal to ambitious men not satisfied with their jobs, their present earnings. More than 4,000 Radio and TV stations now on the air. More than 150 million home and auto Radios. 40 million Television sets. Color TV promises added opportunities. For trained men, there are good jobs, bright futures, security and prosperity in Television-Radio Servicing or Broadcasting. Soon after enrolling, many N.R.I. students start to earn \$10, \$15 a week extra in spare time fixing sets. Some make enough extra to start their own TV-Radio shops. N.R.I. training is practical—gets quick results. N.R.I. lessons are easy to understand, well illustrated, teach you basic principles. And you also LEARN-BY-DOING by practicing with kits of equipment which "bring to life" things you read about in the lessons.

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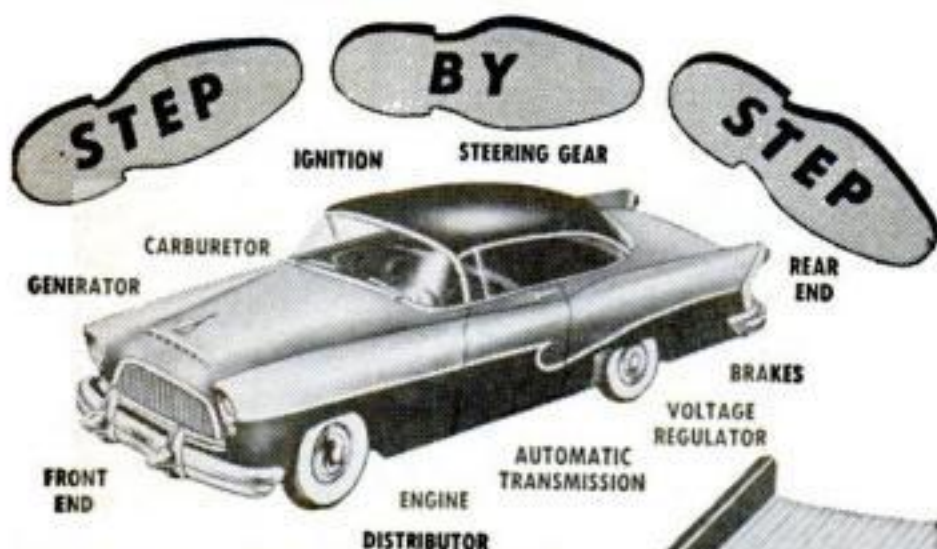
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is misleading. How many of the other 1957 models can Mr. Lindsay run in both directions? Were he to try he would find himself involved in ignition, starter, cooling pump and, in some cases, valving problems!

Mr. Lindsay is incorrect in stating that the Mark 75 discharges its exhaust through the propeller hub. This feature appears on the Mercury Mark 10, not the Mark 75.

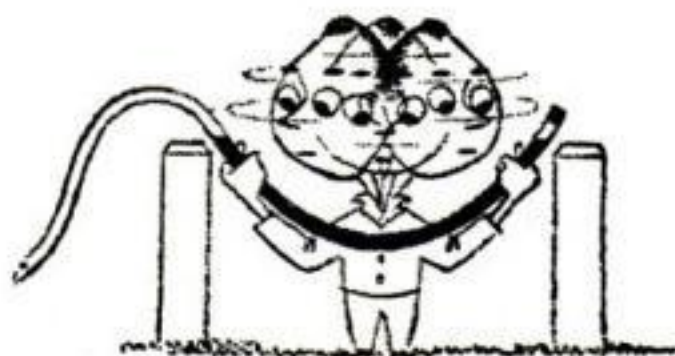
3. Your writer errs in stating that the forward rake design of the Mark 10 follows a development of other manufacturers' engines having sloping propeller shafts. The Mark 10 does *not* have a sloping propeller shaft. Instead, the entire powerhead and driveshaft housing are raked forward to provide for easy drainage of unvaporized fuel from the engine interior and to permit the engine to ride easily over submerged obstructions. The propeller shaft is horizontal. The purpose is *not* to "have the propeller stick out behind the boat" or to have the "lower unit submerged less than formerly." Mr. Lindsay might care to know that we are the originators of the "Glide-Angle" and hold patents thereon.

4. Slip clutches, 12-volt starters and generators, and multi-colored engines are not 1957 developments insofar as Mercury is concerned. We have featured slip clutches, just now becoming popular with the rest of the industry, for over a decade, even to discarding the shear or drive pin in favor of a splined drive. Similarly, weight and design advantages led us to the use of 12-volt electric starters and generators in 1954. Finally, Mercury offered two-toned and multi-colored styling as early as 1955.

While we appreciate the many kind things Mr. Lindsay had to say about Mercury engines, we do feel that the facts and corrections should be placed before your readers.

E. C. KIEKHAEFER, President
Kiekhaefer Corp., Fond du Lac, Wis.

Thinks a Water Level Is Better



IN YOUR article "The Spirit Levels You Should Own" [March] you say "you can't

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Costs far less than cast iron
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LIGHTWEIGHT. (46½" tub weighs only 18 lbs.) Can be carried in your car and into your home without the slightest difficulty or fear of damage to tub or home.



WARM, QUIET. Surface and material entirely different from any other tub giving a "quieting" effect and a pleasantly warm, velvety touch. Keeps bath water warm lots, lots longer.



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ALL COLORS

46½" and 54" models weigh 18 and 25 lbs. (54" Strandglas tub has leg room of standard 60" tubs.) Right and left hand drains. Gloss white and all standard colors.

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Simple, easy-to-follow installation instructions furnished with each tub.



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JUNE 1957 9

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It's always "open season" with the Savage 340 . . . chambered for 2 great varmint cartridges and America's most popular deer caliber. Stock has medium-high comb and trim lines for steady handling, fine balance and streamlined appearance.

This rugged bolt action repeating rifle has a ramp front sight and rear sight with elevation adjustment . . . drilled and tapped for popular receiver sights and 'scope mounts. Available in 3 great calibers:

.222 Remington 50 grain bullet

The advanced design of the 340 brings out the ballistic potential of this high velocity, flat-shooting cartridge.

.22 Hornet 45 grain bullet

An economical cartridge that delivers peak accuracy in the Savage 340.

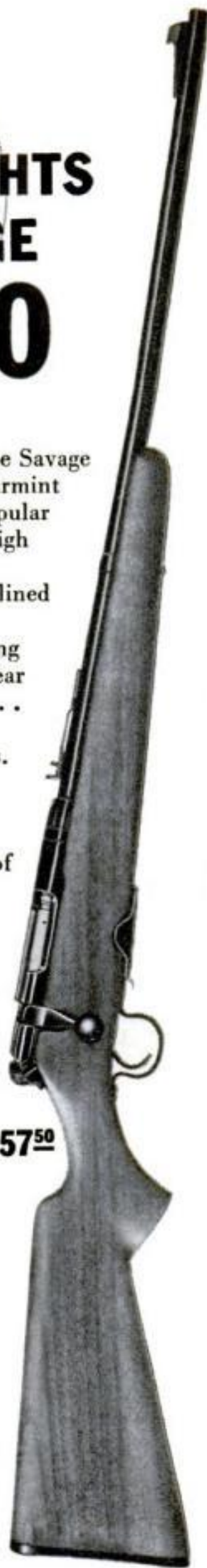
.30-30, 150 and 170 grain bullets

For more than 50 years it has proved its effectiveness on deer and medium-sized game.

The 340's exclusive head space control and specialized Savage manufacturing methods give you extreme accuracy at a price so low you can buy the 340 complete with 'scope for less than you might expect to pay for the rifle alone. See it at your dealer's now.

There is a complete line of Savage, Stevens and Fox shotguns and rifles for every shooter and every kind of shooting. Write for free rifle or shotgun catalog. Savage Arms Corp., Chicopee Falls 19, Mass.

\$57⁵⁰



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ALL PRICES SUBJECT TO CHANGE . . . SLIGHTLY HIGHER IN CANADA

beat a surveyor with a \$500 or \$750 instrument." I do not agree. I believe a water level is the most accurate leveling instrument there is. Everyone at home has a water level as close as the nearest plastic hose.

JOHN W. SOMMER, Dearborn, Mich.

The story compared a surveyor's transit with a homemade sight level—not with a water level. It's true that water levels are accurate, but they are not generally used at long distances, when they would be very cumbersome to handle.

PS Shortened the Queen Elizabeth

IN "Will This Furnace Yield H-Power?" [March] the diagram gives the S.S. Queen Elizabeth's length as 987 feet. My 1957 World Almanac says 1,031 feet.

JEFFREY FLETCHER, Bay Shore, N. Y.

So does ours. But our 1956 almanac said 987.4—1,031 including the fantail and protruding bow.

A Fuel-Priming Short Cut

I OFFER this suggestion to the mechanic who has just finished working on his fuel pump or fuel line and wants to prime the system quickly—without grinding away on the starter:

Just before you connect the fuel pump, blow hard into the end of the line running back to the tank. (This seems to compress the air above the fuel level.) Then quickly connect the gas line to the pump. On rebound, gasoline will usually fill the fuel line and pump.

P. G. CRISTEA, Bucharest, Rumania

Canadian in Rough Company

IS IT your desire to start another War of 1812? In "U.S. Jets Keep Watch on the Rhine" [April] you say on page 90, top left-hand corner, that the silhouettes on the wall are Russian aircraft. But in the left-hand column, third plane from the top, is a silhouette of a CF-100—a Canadian plane.

D. McNALL, Toronto, Ontario, Canada

Nestled in with the ready-room silhouettes of Badger, Bear, Bison, Farmer and Flashlight there was indeed a Canadian CF-100.

Wants a Story on Foreign Cars

I LIKE PS because it has a lot of information on what is new in automobiles. In the near future I hope you will have an article

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G. F. Beane, W. Virginia, was a truck driver. He took the DeVry Tech Training Program, and is now a technical electronics sales representative.



Edward Hahn, Illinois. Was a laborer, now an electronics project engineer with Televiso, Inc. DeVry Tech training helped him prepare for his present position.



Nick Barton, Illinois, came directly from high school to DeVry Tech. Now has his own service shop and tells us he is "literally snowed with work."



George D. Crouch, California, was a retail store clerk. He took the DeVry Program, and today is in the servicing field for himself.

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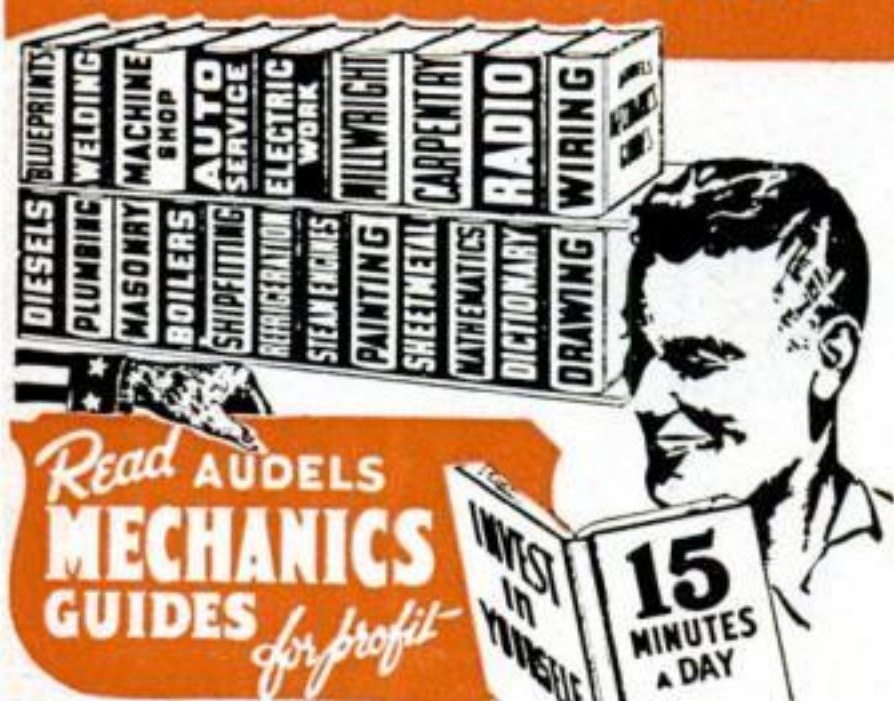
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on the best two-cycle-engine cars in Europe.
L. C. HANNA, Lutz, Fla.

No sooner said than done, Mr. Hanna.
See page 59 in this issue.

Disapproves of Bomber Cover

PLEASE do not send me any more copies of your magazine. Over here there are quite a few of us who do not consider a "deadliest bomber" to be possessed of that quality of glamour as to deserve such colorful prominence as on the cover of the last copy [Jan. '57] I received.

. . . I beg to express my regret at the overemphasis in your magazine of the prostitution of science in the cause of war. The fact that science is used in the development of ever more destructive weapons may be considered unavoidable in the state of the world today. But is it necessary to treat such subjects as matters of popular interest, giving them an aura of matter-of-factness, even of romance and adventure, to youth?

H. W. HEASON, Nottingham, England

Reader Heason poses a subject for debate: Would ignoring a destructive weapon make it less destructive?

Test Record Got the Drift

THE PS Test Record [Jan., March issues] is a wonderful device for testing hi-fi equipment. Owing to your record I was able to find a frequency drift in my equipment. It was used to demonstrate my problem to the dealer who sold me the unit. On the basis of PS's reputation, the dealer rectified the trouble.

DIEGO DANIELLO, President
Manhattan Color Laboratory, Inc., NYC.

Popular Science Test Records will continue to be available until further notice at \$3.50 for one record, \$5 for two. If your dealer cannot supply them, send check, cash or money order to Records, Dept. PS 657, 104 E. 26th St., New York 10, N. Y.

New Antenna Does Wonders

BECAUSE I am in the TV tower business, the first article I read in the March issue was "New Antennas Boost TV Pictures."

We have just put up a new antenna and can say amen to your article. The three-year-old Zenith now brings in a clearer picture than it did when it was new.

PAUL I. HARSHMAN, Chicago

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President
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Train at home in spare time for a better job in this uncrowded industry. For complete information, fill out and mail coupon. Do this today.

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Many students, soon after they start training, do repairing in spare time. They work with local dealers evenings and week-ends. Others go "on their own." They earn extra cash, get added experience. Some land full-time jobs while students, and quite a number open shops. All this is possible because CTI training is so practical.

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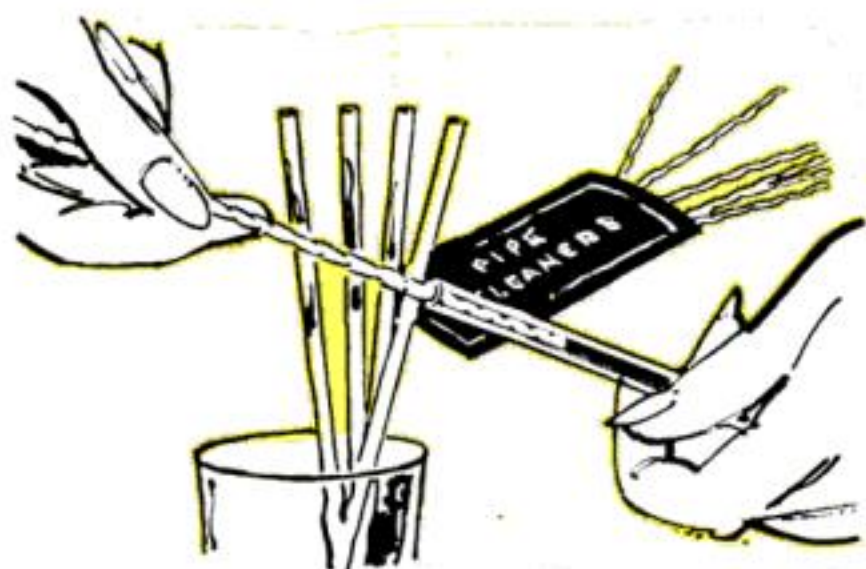


ICE-CUBE TRAYS SLIDE OUT SMOOTHLY without sticking if a sheet of clear plastic wrap is laid in the refrigerator compartment before the water-filled trays are slipped in for freezing.

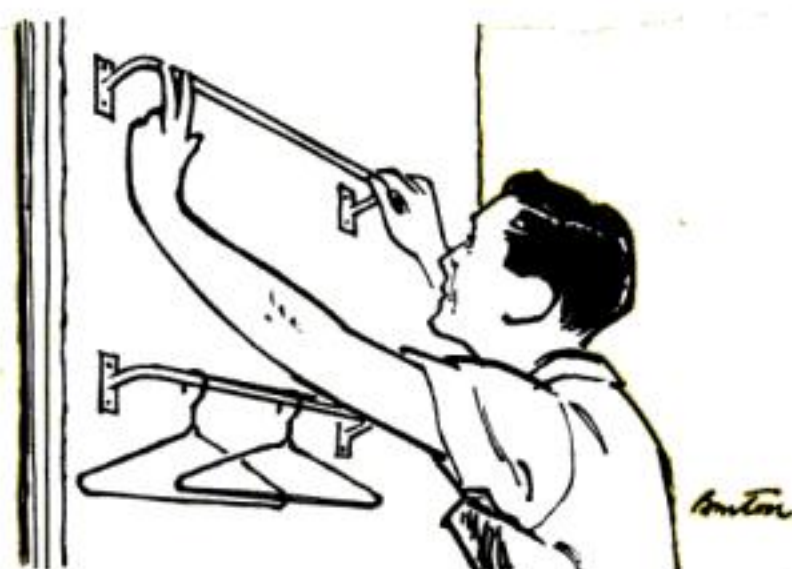


FOR MORE ROOM ON A SMALL TABLE set against a wall, mount stepped shelves on brackets just above the table and finish them to match the kitchen counters. The narrow shelf will hold

small items used at every meal. The bigger one will give you space to park a toaster and percolator at breakfast; vegetable bowls and a meat platter at the dinner hour.



CLEANING SIPPERS made of glass or plastic is easy if you use a pipe cleaner. Soak the tube in sudsy water, run the cleaner through it and rinse it under the hot-water faucet.



A TOWEL RACK is a good stretcher of closet space. Screw one to the underside of a low shelf, or fix a pair to a side wall to hold an upper and lower row of short garments.

Handsome New 1957 GENOVA WATER & SHOCK RESISTANT WATCH

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OUR greatest watch bargain since 1947! Handsome, rugged 1957 Genova water and shock resistant timepiece—engineered to rigid Swiss precision standards—yours for only \$7.98. Not an ordinary watch . . . as radically different from other low cost watches as night and day! Bang it! Jolt it! Wet it! The Genova is ruggedly built! Use it in the field, on hunting & fishing trips. It's a real WINNER!

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MULTI-PROTECTED! Resists shocks at work or play. Sealed-in safeguard gasket resists water, grime, dust. Yes! It actually runs under water!

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• Yes . . . compare the Genova with watches selling for \$49.95 for its elegant, very thin design, its modern applique dial, its smart, distinctive looks, its truly durable construction! Don't let our low price confuse you. The Genova is precision-made and electronically time-checked for satisfying performance. Even if we were to charge you TWICE the price, we couldn't give you a more accurate timepiece!

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This ad will appear in over 100 magazines and newspapers reaching 60,000,000 people. Better order yours NOW—before they are sold out! **LIMIT**—one watch per family so we can please as many new customers as possible. Mail coupon for 10-day trial. **YOUR MONEY REFUNDED** promptly if not completely satisfied. And remember, you receive the famous THORESEN watch guarantee of FREE service. FREE oiling, FREE adjusting, FREE labor. See unlimited Guarantee Certificate above. This guarantee comes to you IN WRITING and is good not only for one year or five years but for the lifetime of this firm. We stand behind our product!

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Make daring water test at our risk!

If, at any time in 5 years, the Genova watch fails to function properly after immersing in water for ONE HOUR, we will replace it with a watch of equal value.

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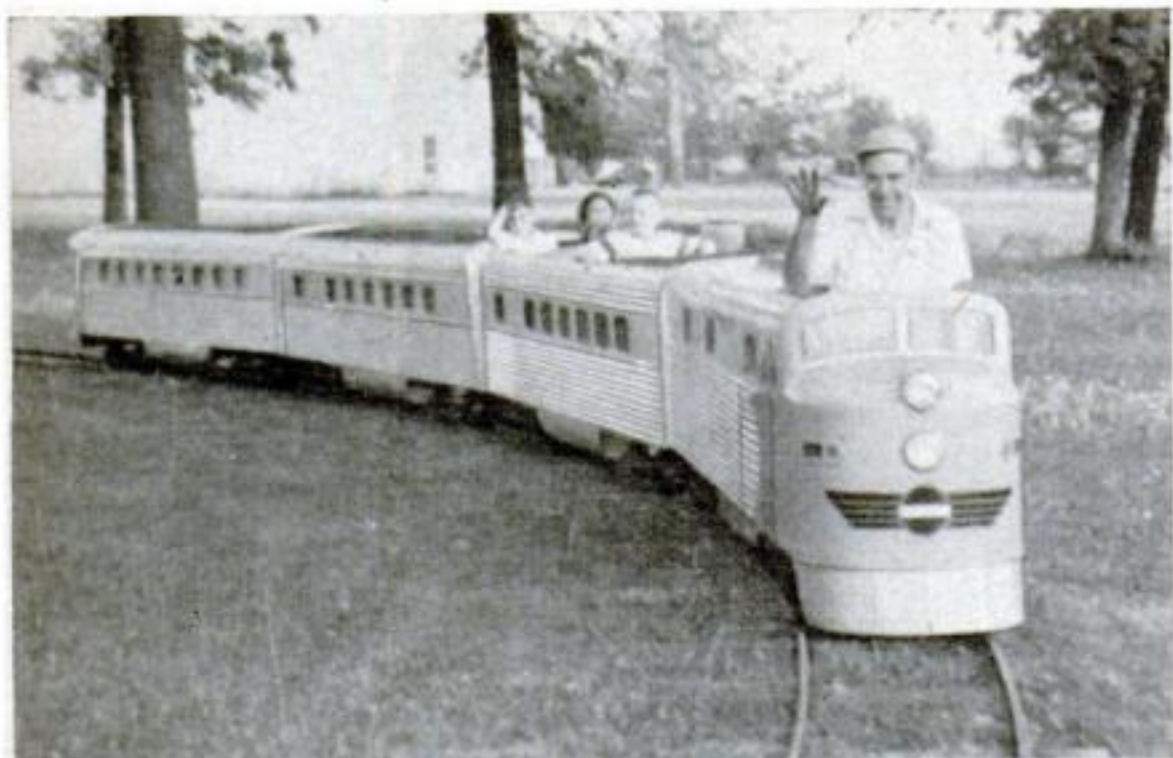
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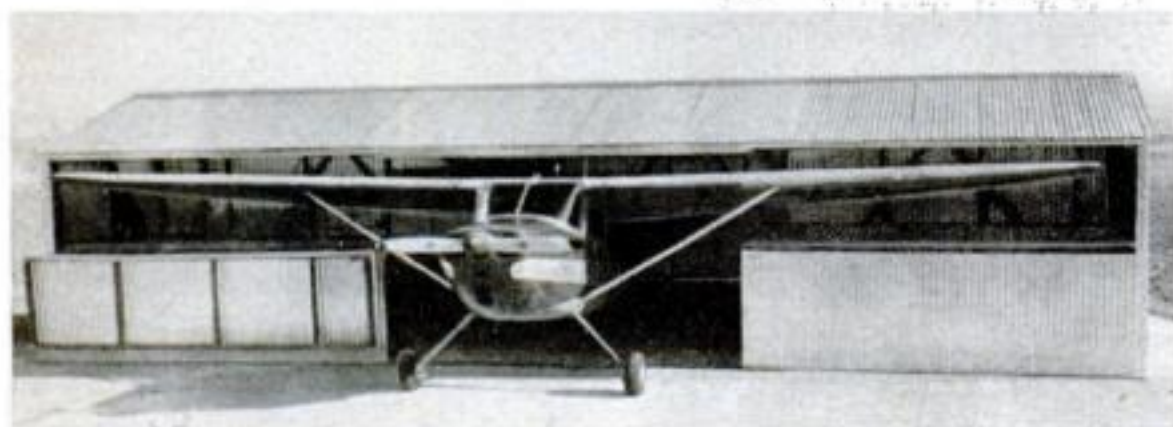
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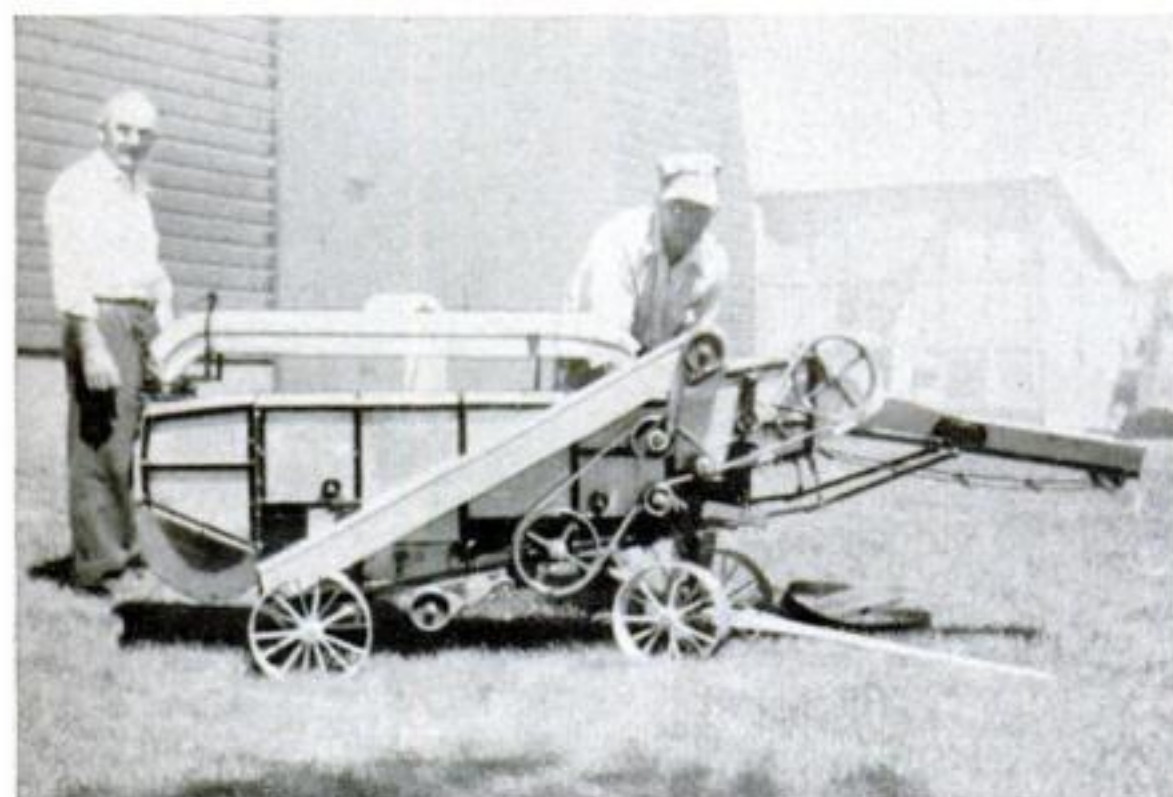
Prize Projects BY PS READERS



Prairie Rattler. Two years of spare time and plenty of angle iron and sheet metal went into this 44-foot train. Built by Roma L. Aman of Marshalltown, Iowa, it is powered by a Chevy engine and transmission, and is chain-driven from motorcycle gears. Air brakes bring it to a fast stop as it rides 12-pound mine rail.



Tight-Fit Hangar. Harry Doose of Oakland, Calif., built a lot of tricks into this hangar of corrugated aluminum. The centered door is hinged horizontally across its middle. When it is rolled to one side and folded in half, and the hinged windows at both sides are dropped, his plane moves in or out with easy wing clearance. A rear extension gives space for berthing the plane's tail.

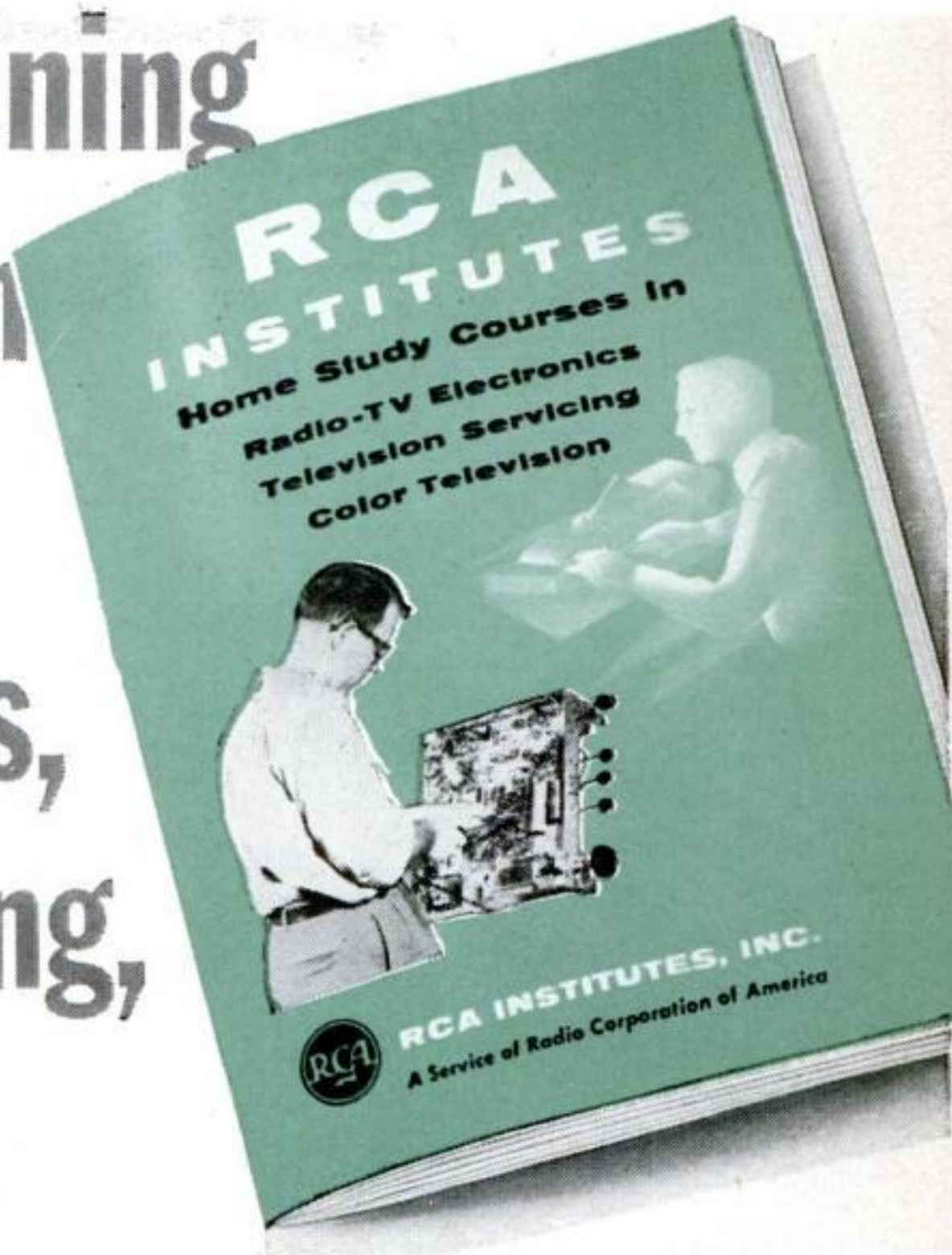


Pygmy Grain Thresher. This scaled-down threshing machine stands only 30 inches high and weighs in at 500 pounds. Although it makes do with an eight-inch cylinder and a 13-inch separator, George E. Schmidt of Tomah, Wis., who built it, says that like the big one it copies, it boasts a folding self-feeder, a swinging blower and a built-in scale.

Have you recently completed a workshop project of which you are particularly proud? Send a good photograph of your work, along with the negative and a brief description,

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JUNE 1957 17

"I'd like to see them make..."



A GASOLINE GAUGE near the filler cap on cars so gas pumpers could tell how much the tank would take, preventing waste and mess from spill-overs.—*Wm. Palmer, Stephentown, N. Y.*



A GRASS-REPELLENT SPRAY for the underside of power mowers. If it were used before mowing, grass clippings wouldn't stick to the works.—*Harold J. Frick, Kokomo, Ind.*



A MULTI-DOOR REFRIGERATOR, with transparent door panels. Then you wouldn't lose a lot of cold air every time you wanted to take out a single item.—*G. W. Kendall, Freeport, N. Y.*



BUMPERS FOR END CABINETS, to save bruised hips. Corner pads of foam rubber, adhesive-backed, they'd cushion the hazardous pointed corners on counters.—*Hilda Feiner, Montreal.*



A MIDGET ROTARY SAW BLADE that would fit into an electric drill. It would be fine for cutting pipe and conduit in hard-to-reach spots.—*R. G. Chamberlain, Lincoln Park, Mich.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by **POPULAR SCIENCE** readers. What's

yours? We will pay \$5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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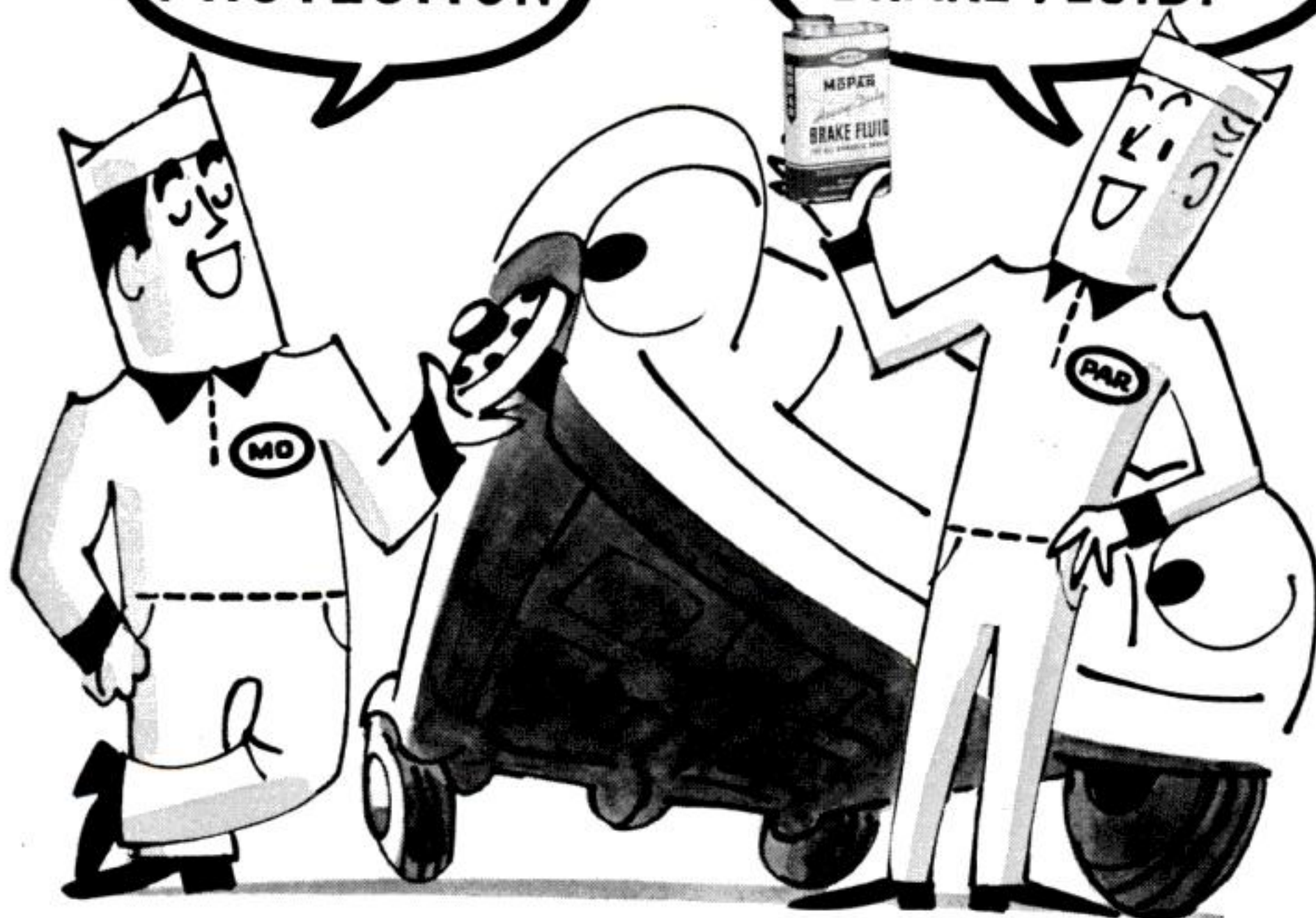
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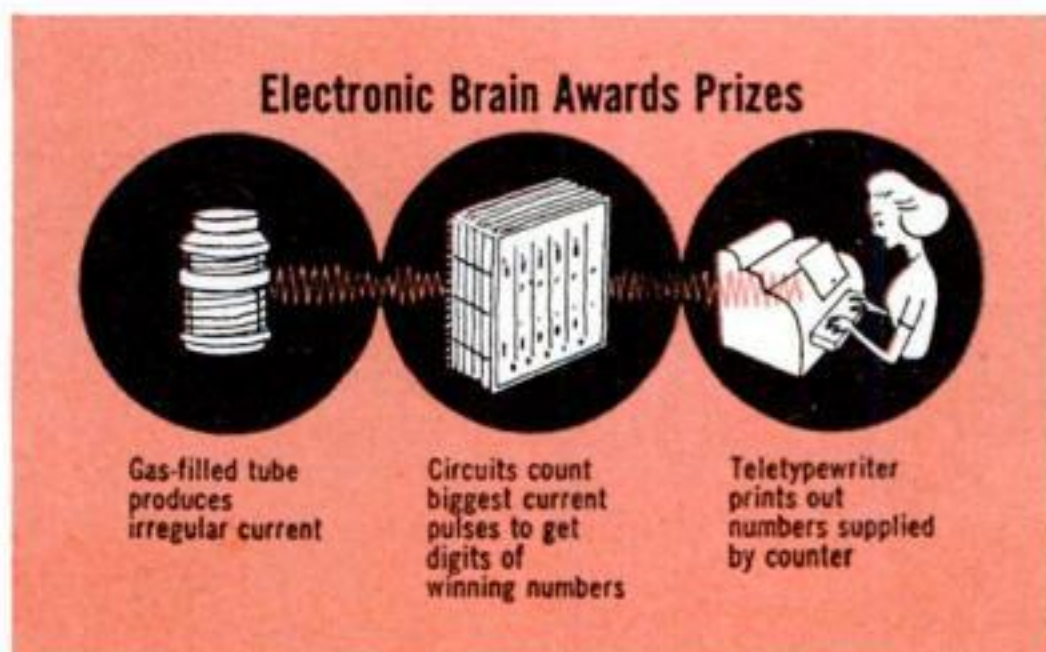
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An electronic numbers game—government sponsored—is going full tilt in Britain this month. “Ernie,” a \$100,000 automatic computer designed especially to pick the winning numbers, is now paying off \$2,600,000 in prize money to the fortunate owners of 22,000 tickets (a total of 45,000,000 tickets were sold the first month).



The high stakes rule out any old-fashioned method such as drawing lucky numbers from a hat. That's why Ernie was built. It has a gas-filled vacuum tube—like part of a neon sign—that produces an irregular electric current varying at random (sketch at left). Weak portions of the current are discarded, leaving

strong pulses. Electronic circuits then count the number of pulses that come through during a period of $1/6$ second. Since the current varies at random, the number counted in $1/6$ second is unpredictable. It may be anywhere between zero and 1,000. The counter feeds the last digit of the actual number it does count to a teletypewriter. In this way the teletypewriter prints out digits making up the serial number of a ticket. Ernie can pick all 22,000 winners in 15 hours.

The British Government refuses to call its “Premium Savings Bond Scheme” a lottery. Nobody loses, because you can always cash in a ticket, or “bond,” for its purchase price. But you don't get any interest on the bond—unless you win. The Government pays interest at four percent into the kitty the prize money comes from. There's a serious purpose behind the idea—it gets John Bull's extra pounds sterling out of circulation (\$130,000,000 the first month), and helps prevent inflation.

There's a new fight on for your TV channels. The Government wants to change some stations from VHF (channels 2 through 13) to UHF (channels 14 through 83). VHF is what most people watch. Only one-tenth of U. S. TV sets are now equipped to receive UHF. If the switch takes place in your town, you'll have to get an adapter for your old set or buy a new set. And if you live some distance from the transmitter, you may not be able to get anything at all, since UHF waves don't travel very far.

Why upset the applecart now? There just aren't enough VHF channels to go around, that's why. There are plenty of UHF channels. But viewers won't bother with them so long as they have VHF to watch. This means the UHF stations don't stand

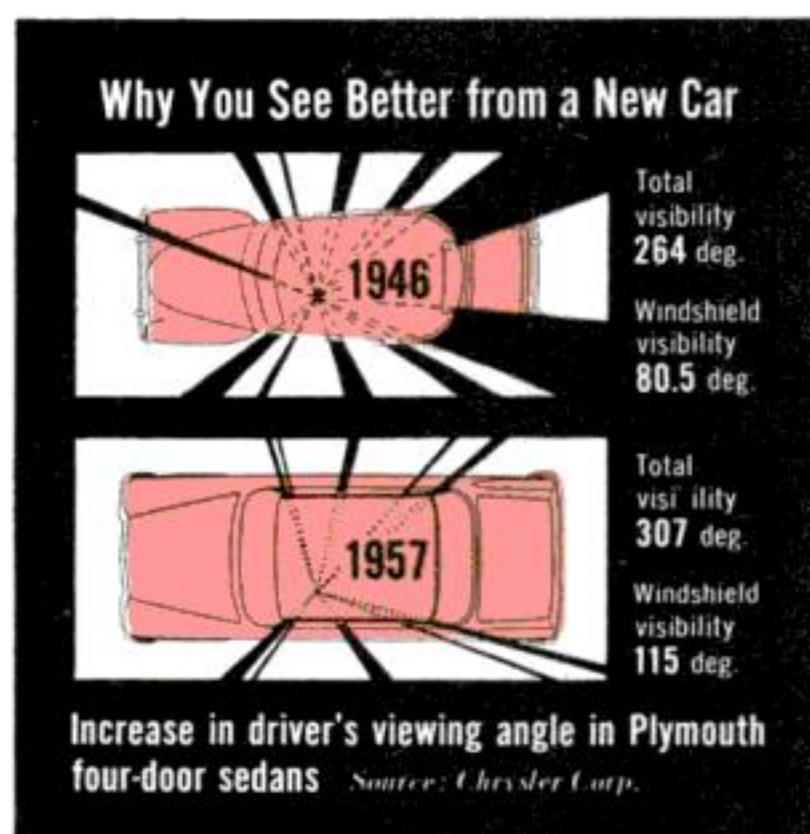
You ought to know...

much chance of competing with VHF stations in their area. So the Government is trying to make UHF more attractive by restricting some areas to one, some areas to the other. If this "de-intermixture" works, there should be a lot more stations on the air and you'll have a wider variety of shows to choose from.

Another move toward greater program choice should come along soon. The Government seems about ready, after years of urging, to give the green light to a big test of pay-as-you-see TV—shows you can't watch unless you drop money in the slot.

What'll they think of next? "Talking" stop signs at some intersections around Chicago warn you by making a rumbling noise when you

drive over the paving. There's rough slag in the asphalt just before the corner . . . "The best insect repellent ever developed"—that's what the U. S. Department of Agriculture says—is coming on the market. The chemical is diethyl toluamide, and it will be used in a bug-chaser trade-named "Off" (S. C. Johnson Co., Racine, Wis.) . . . Press your summer suit in an automatic dryer? It works, says Dupont. "Wash-



and-wear" clothes made with Dacron or Orlon lose their wrinkles while retaining their creases if tumble-dried at 160° to 170° and then tumbled a while with the blower on and the heat off. Some new suits and slacks designed specifically to take the rough handling are now in stores . . . Many '58 TV sets will have the new 110-degree picture tube, which is shorter than previous types and permits a shallower cabinet. Really flat tubes are under development—by practically every big set-maker—but aren't ready yet . . . New varieties of shade trees are coming. The first you're likely to see is hybrid maple that grows in a narrow shape, desirable for street plantings. Better types of cherry, linden, sycamore and even a rubber tree are also being grown.

A light appetite for gasoline was demonstrated by the Chrysler stable of cars, which swept this year's Mobilgas Economy Run. An Imperial Crown, throttled by Mel Alsbury Jr., took top prize with 64.5 ton-miles per gallon (actual gas consumption: 20.9 miles per gallon). Plymouth Belvedere V-8, Dodge Coronet 500 V-8 and Chrysler Saratoga also beat the competition in their classes.

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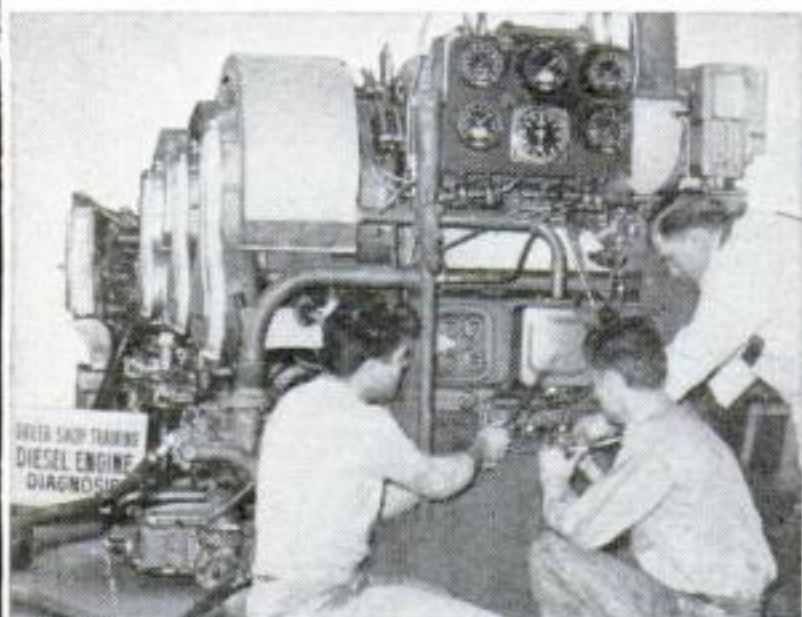
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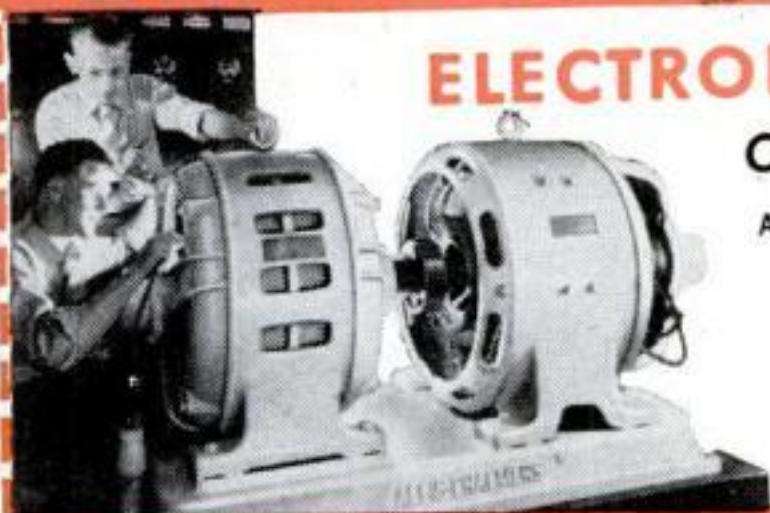
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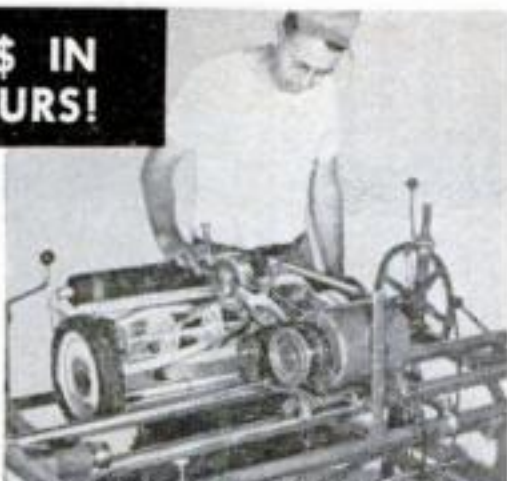
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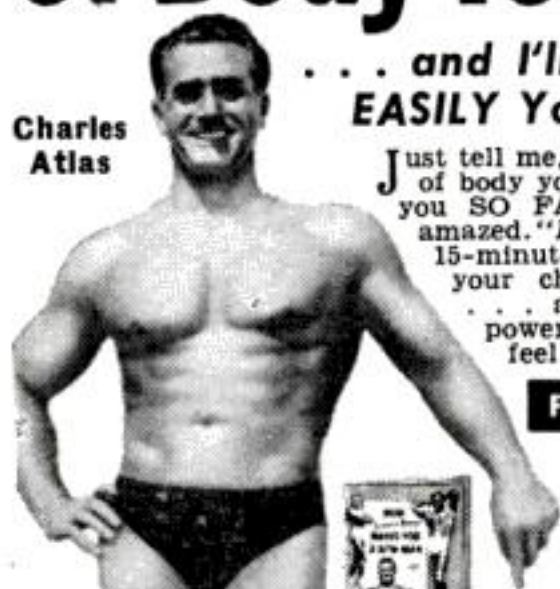
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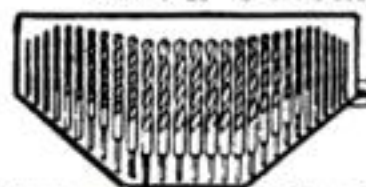
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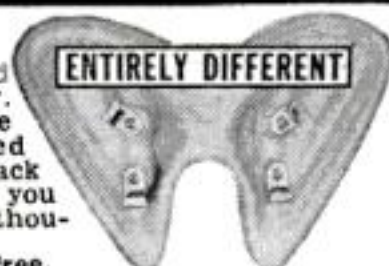
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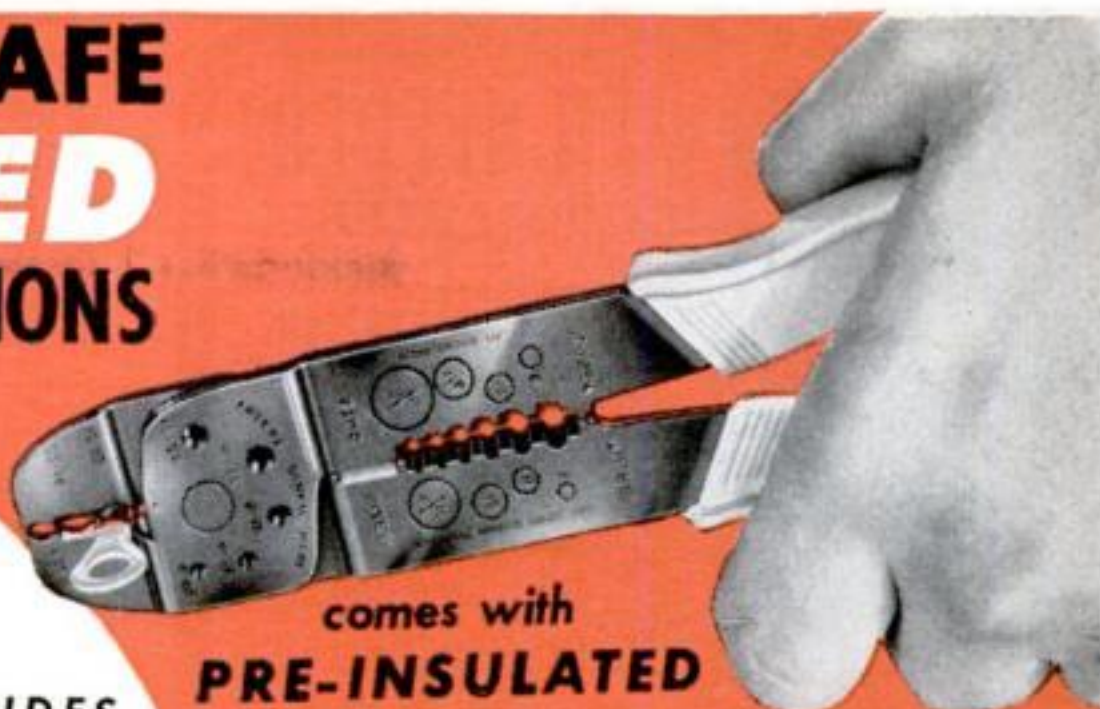
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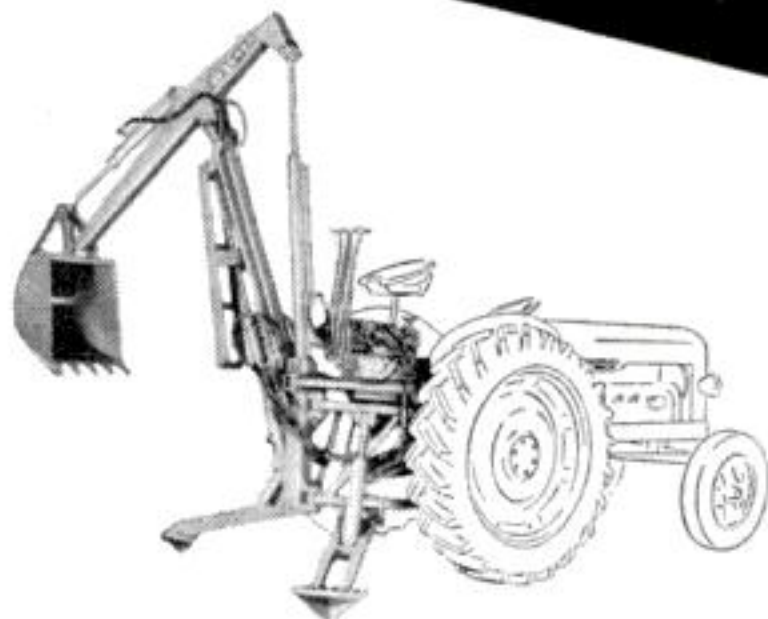
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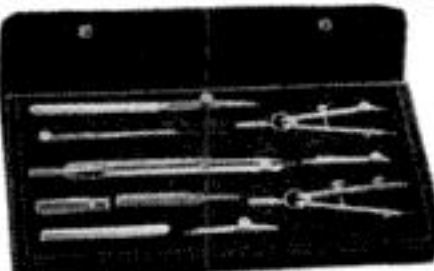
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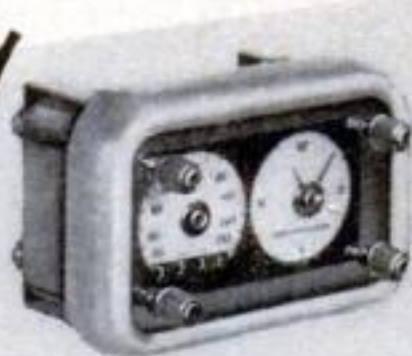
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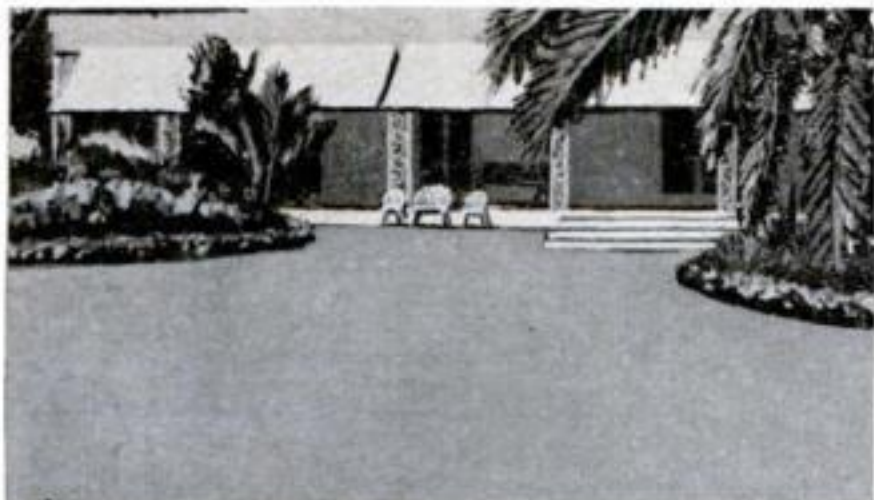
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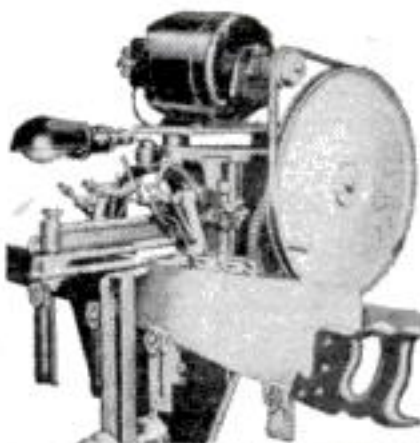
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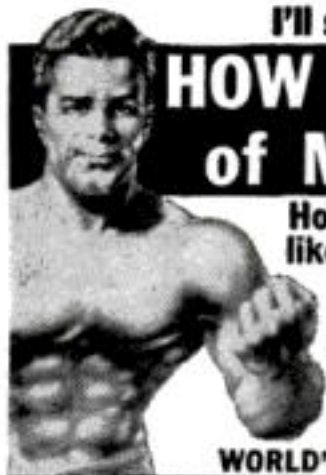
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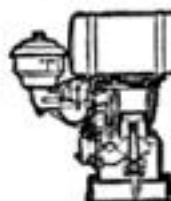
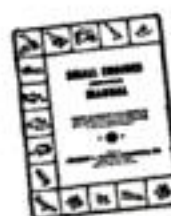
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USE THIS HANDY INDEX TO FIND WHAT YOU WANT

Advertising, Agencies for Advertisers...	53
Agents Wanted	43
Antiques, Relics & Indian Goods	29
Artists Supplies	76
Authors Service	52
Auto Supplies & Equipment	2
Auto Trailers	3
Automobiles & Midget Cars	1
Aviation	5
Batteries, Generators, Etc.	6
Boats, Outboard Motors	11
Body-Building Courses, Jiu Jitsu, Etc.	12
Books & Magazines	23
Build It Yourself	66
Business Opportunities	37
Business Service, Information, Name Lists	50
Buy It Wholesale	38A
Cameras, Photo Supplies	31
Camping Equipment & Tents	16
Cartooning, Sign Painting, Chalk Talks	54
Chemistry & Physics	41
Claim Investigators	37A
Coins & Currency	26
Color Photo Finishing	32A
Contests	46
Detectives	47
Dogs, Birds, Hamsters & Pets	17
Earthworms	18
Educational & Instruction	43
Electrical Supplies & Equipment	7
Enamels, Paints & Varnishes	64A
Engines, Motors, Etc.	10
Farms, Other Real Estate	19
Field Glasses, Telescopes	14
For Inventors	60
For Sale Miscellaneous	71
For the Home	69
Formulas, Plans, Etc.	39
Games & Entertainment	24A
Geiger Counters, Treasure Finders	77
Help Wanted	42
High-grade Salesmen	44
Hobbies, Collections	31
Home Craftsman	65
Hypnotism	24
Inventions Wanted	61
Language Outfits	48
Machinery, Tool Supplies, Etc.	9
Magic Tricks, Puzzles, Etc.	25
Manufacturing	63
Memory Training	45A
Minerals & Precious Stones	30
Miscellaneous	79
Models, Model Supplies	64
Money-making Opportunities	38
Motion Pictures, Slides, Sound Equip.	33
Motorcycles, Bicycles & Supplies	4
Music, Song Writers & Records	35
Of Interest To Women	70
Old Gold, Jewelry, Watches	67
Old Stamps Wanted	27
Patent Attorneys	59
Patents For Sale	62
Personal	80
Photo Finishing, Photocopies, Etc.	32
Plastics	40
Plays, Stories, Etc.	49
Poultry & Supplies	21
Printing, Multigraphing, Etc.	57
Printing Outfits Supplies	58
Profitable Occupations	22
Radio, TV, Supplies & Equipment	36
Razor Blades, Shavers	74
Rubber Stamps & Office Supplies	56
Special Services	51
Sporting Goods, Guns, Fishing Tackle	15
Etc.	28
Stamp Collecting	28
Surveying Instruments	79A
Tattooing Supplies	75
Tobacco & Pipes	68
Trees, Shrubs, Roots & Herbs	20
Typewriters & Office Machines	53
Wanted to Buy	72
Watch Repairing	78
Wearing Apparel	73
Welding, Soldering	8
Wood Preservatives	63A

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GIANT Directory Reveals 7,000 Wholesale Sources. George Lucas, Bellevue 1, Washington.

FREE! "How To Turn Rags Into Riches!" Metro, Dept. E, Box 151, Oak Park, Illinois.

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MAKE \$46 From Square Foot Plywood; Jigsaw necessary. Free Information. Woodarts, P-7, Bridgewater, Massachusetts.

WHOLESALE Prices. Free Information. National Wholesale Service, Box 397, Buffalo 5, New York.

38 MONEYMAKING OPPORTUNITIES

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MEN—Women! Start Money-Making Plastic Laminating Business at home in spare time. Material that costs 11c brings back \$2.58. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars Free. Rush name on postcard to Warner, Room 8-H, 1512 Jarvis, Chicago 26, Illinois.

DETECTIVES—Work home—Travel. Experience unnecessary. Detective Particulars free. Write. Wagoner, P-125 West 86th, New York 24.

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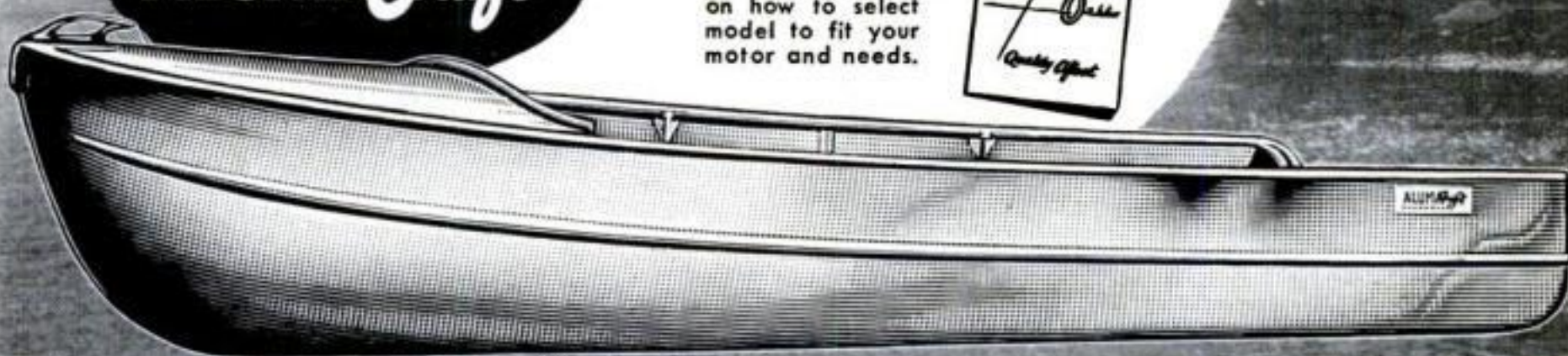
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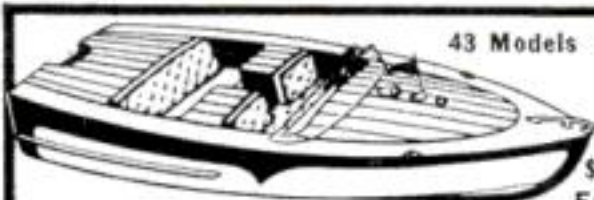
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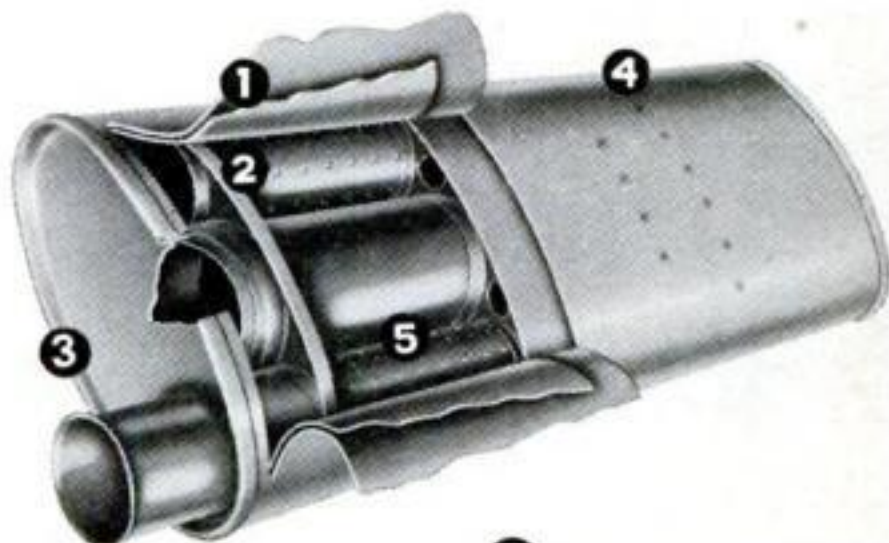
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An underground nuclear plant of about 75,000 kilowatts will furnish heat for Vasteras, a city of 45,000 inhabitants. A similar installation will serve Farsta, a Stockholm suburb with a population of 50,000. Due for completion in 1960, these will be the first of five or more A-heating plants projected by the government-controlled Swedish Atomic Energy Company to make Sweden less dependent upon imported fuel.

Through hot-water mains of a district-heating system at each locality, a pumping station will deliver pressurized water at 210 to 250 degrees to consumers.

A plant's nuclear reactor will burn natural uranium in a core immersed in heavy water. Heated by the chain reaction, the heavy water goes to a heat exchanger—which in turn heats ordinary water for circulation through city mains, without allowing any radioactivity from the reactor to get into it.

Despite its promise, A-heating has been tried only rarely and on a modest scale before. In the world's first installation, at Harwell, England, an experimental reactor has heated an office building's hot-water radiators since 1951. The first and only A-heating plant in the U. S., placed in operation in 1955 for buildings of the Hanford, Wash., atomic center could heat 1,000 average homes. But Sweden's big projects will be the first to serve the public.

Nuclear heating offers an ideal way to harness the atom, says Albert I. Brayman, Boston consulting engineer and designer of Hanford's A-heating plant, who urges its bigger-scale application here. It uses directly the energy that a reactor yields as heat—saving 70 percent or more lost in turning the heat into electricity. And heating reactors are called much simpler, and less costly to build, than power reactors.



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Pictured on this month's cover are the Karmann-Ghia Volkswagen (front) Renault Dauphine, and Saab (rear)



What You Get in the Foreign Economy Cars

***They're agile, easy to park, mechanically simple, rugged,
relatively cheap—and, of course, easy on the petrol.***

By Devon Francis

MAN we know who owns a little foreign car got a snub from a neighbor last fall.

"Those little things," said the neighbor loftily, "must be fun to drive on your day off."

Months later he was eating his words. He couldn't get his heavy, powerful Chrysler out of his snowy driveway. The little foreign car took to the treacherous footing like a snowshoe rabbit, and he had to bum a ride in it.

Performance on bad roads is one of the things you get in the little foreign cars. They're built for it.

They have other happy attributes. They go a long way on a gallon of gas. They park easily. They are mechanically simple. They don't change style every time the trees shed their leaves. They're well made. Finally, most of them are relatively cheap to buy.

The "pool estimates" of sales by the marketers of the little foreign cars over here this year run as high as 200,000 automobiles. (From 125,000 to 150,000 would, perhaps, be more realistic.)

They say that the meteoric rise in their sales here—from 25,000 in 1954 to

almost 100,000 in 1956—denotes a "rejection" by American motorists of Detroit's big, bulbous, "overpowered" products. That's strong talk. The importers accounted for only one new-car sale in 60 in this country last year. But sales in 1955 doubled those in '54, and those in '56 almost doubled those in '55. Last year, Volkswagen alone outsold such American cars as the Hudson, Continental, Lincoln and Imperial.

The U.S. motor industry is taking notice. In a few weeks the Studebaker-Packard Corp. will introduce a new "economy" car to sell, in its cheapest version, for less than \$1,800. And more British-made Fords were unloaded at U.S. ports during the first two months of this year than in all 1956.

POPULAR SCIENCE recently tried out four of the little foreign cars (out of two dozen or more now available in this

.....

What we liked about:

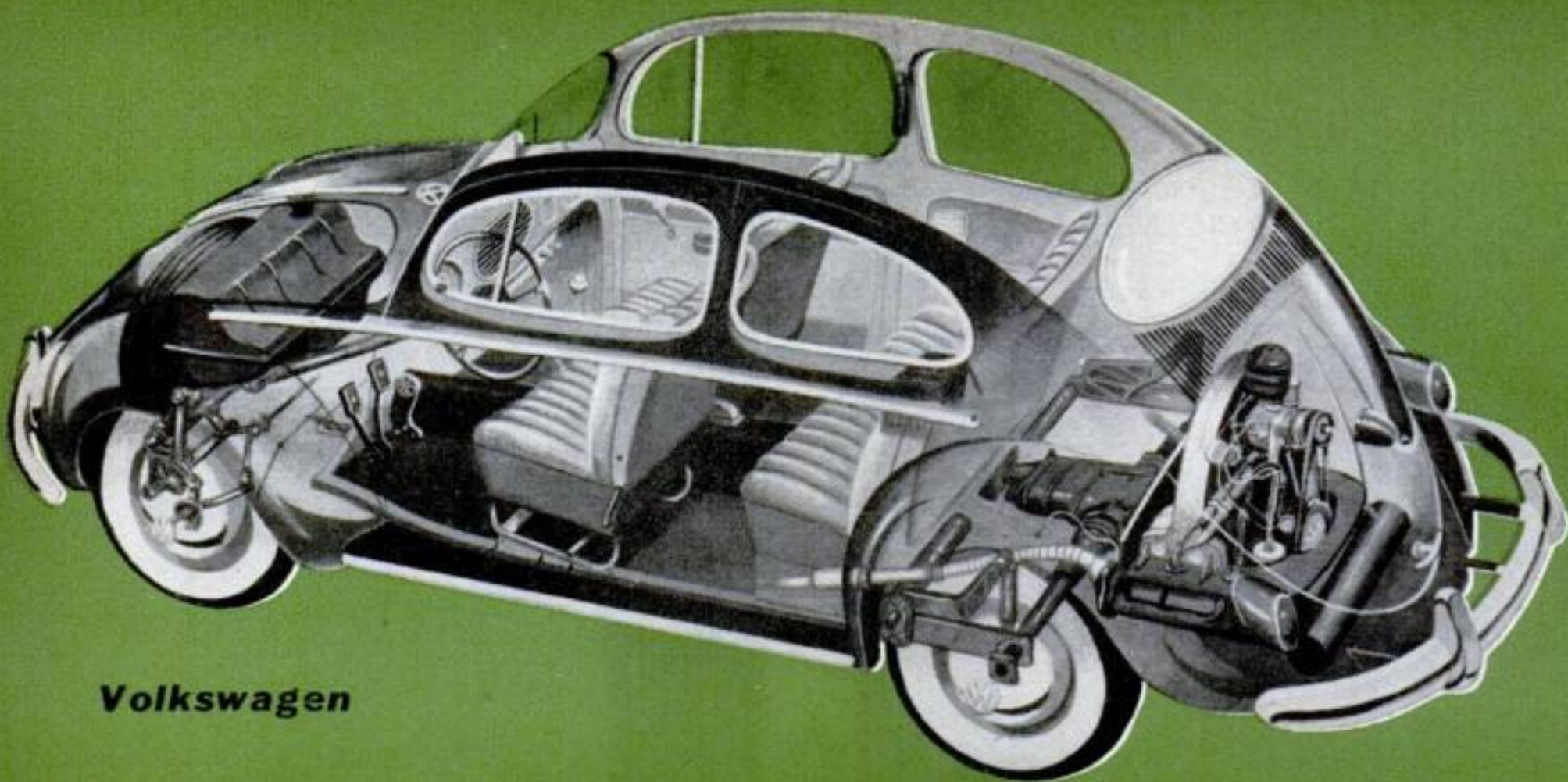
THE KARMANN-GHIA VOLKSWAGEN—the beauty.

THE SAAB—the stability.

THE RENAULT DAUPHINE—the ease of driving.

THE ISETTA—the ease of entry.

.....



Volkswagen

CUTAWAY OF VW in standard body shows simplicity of construction. Ribbed floor pan contributes to overall body stiffness. Its four

cylinders are horizontally opposed. Displacement is one-fourth that of a '57 Chevrolet, fuel capacity and consumption about half a Ford's.

country—see chart on page 64). They were the German Volkswagen (pronounced Folks-vaagon) with a Karmann-Ghia (Ghee-ah) body, the Swedish Saab (Sob), a French Renault Dauphine (Renno Dough-feen) 5 CV, and a German BMW Isetta (I-setta).

These cars are like oysters—you have to acquire a taste for them. They range in horsepower from 10 to 86. And they *are* tiny. Four people can ride in the

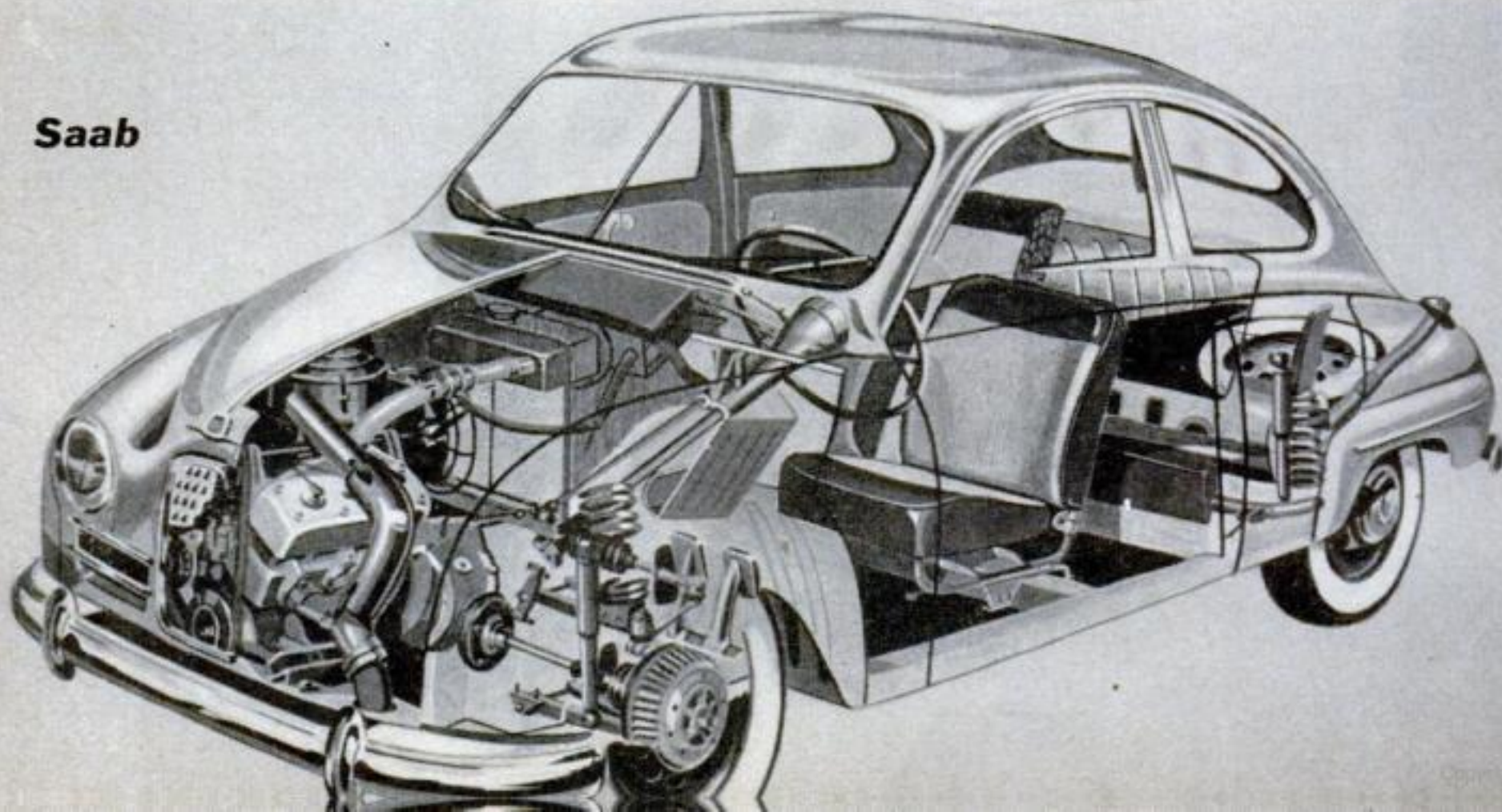
Saab or Renault, but those in the back seat can hardly play games. The Isetta will accommodate two grownups and a child; the VW Ghia just two (as against four for the standard VW). Yet the entry room in these cars is better than that on a good many 1957 U. S. cars.

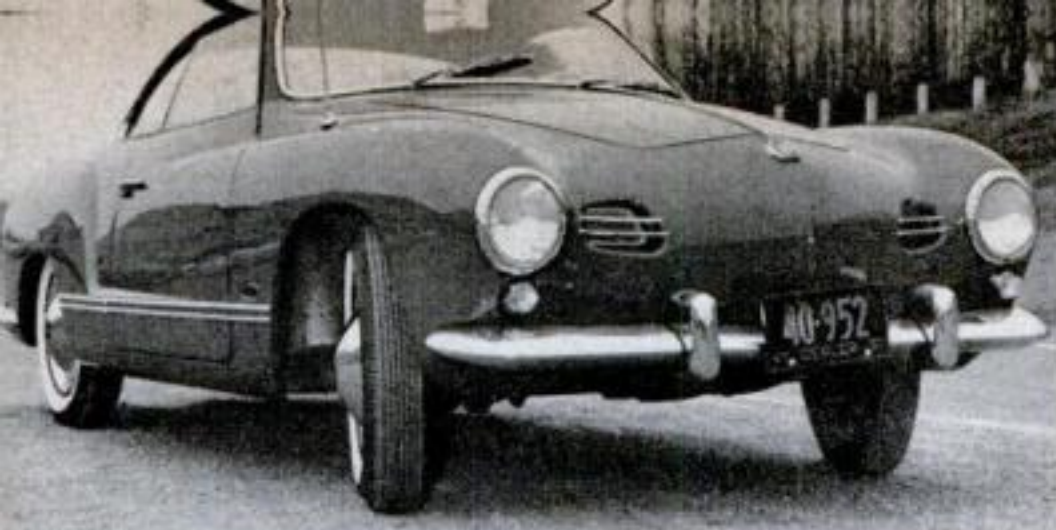
The Ghia excepted, these cars are not pretty. The Isetta, in particular, is like a buck-toothed girl with a 34-24-34 figure—homely but cute. The Renault and Saab

FRONT-WHEEL DRIVE on Swedish import gives car exceptional stability. Free-wheeling permits shifting without clutch. Instructions on panel

controls are all in international picture symbols. Like most foreign cars, the Saab is built to run wide-open all day without damage.

Saab





KARMANN-GHIA BODY on VW reduces passenger capacity to two. Right front seat is reversible. Price: \$1,000 more than standard VW.

look, to an American, as if they had been worked over by a head-shrinker.

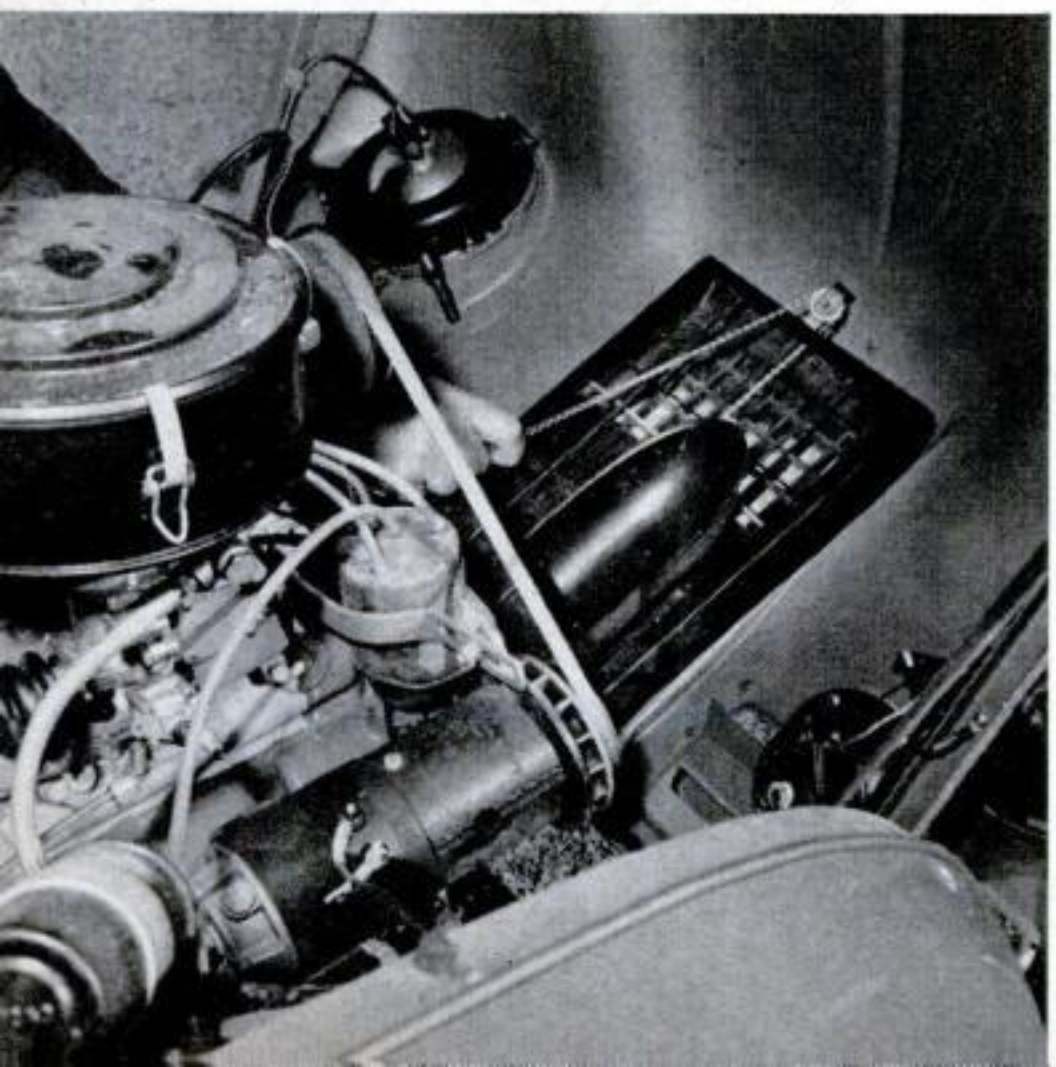
My wife looked biliously at the Saab when I brought it home.

"Couldn't you put it somewhere else?" she asked. "Say, *behind* the house?"

Well, every man has to field such bunts in his own way. Then a woman neighbor saw the Saab and oohed:

"American cars *all* look alike. Now *this* car has a certain esthetic appeal."

SAAB'S ENGINE IS CANTED left to make room for accessories. It starts instantly in zero cold. Roller blind deflects air for warmup.



An hour later I overheard my wife remark to someone on the telephone, "It's small, but it's a sort of esthetic experience, you might say."

Snob appeal, cartooned as the suburban matron who meets her man at the commuter train in a Jaguar with a flagon of Martinis, undoubtedly is one of the compelling reasons why people buy the little foreign cars.

What are the other reasons? Let's take a look:

The Karmann-Ghia Volkswagen

This car is sheer fun. It has everything, except passenger capacity, that the regular beetle-body VW has, plus the style that only the Italians can give an automobile. The bodies are made under Italian license.

The Ghia does not have the torque in high gear of either the Renault or the Saab. Shifting the four-speed box requires dexterity. But the clutch is smooth, and the floor-mounted stick, within comfortable reach, slides through the gears like silk.

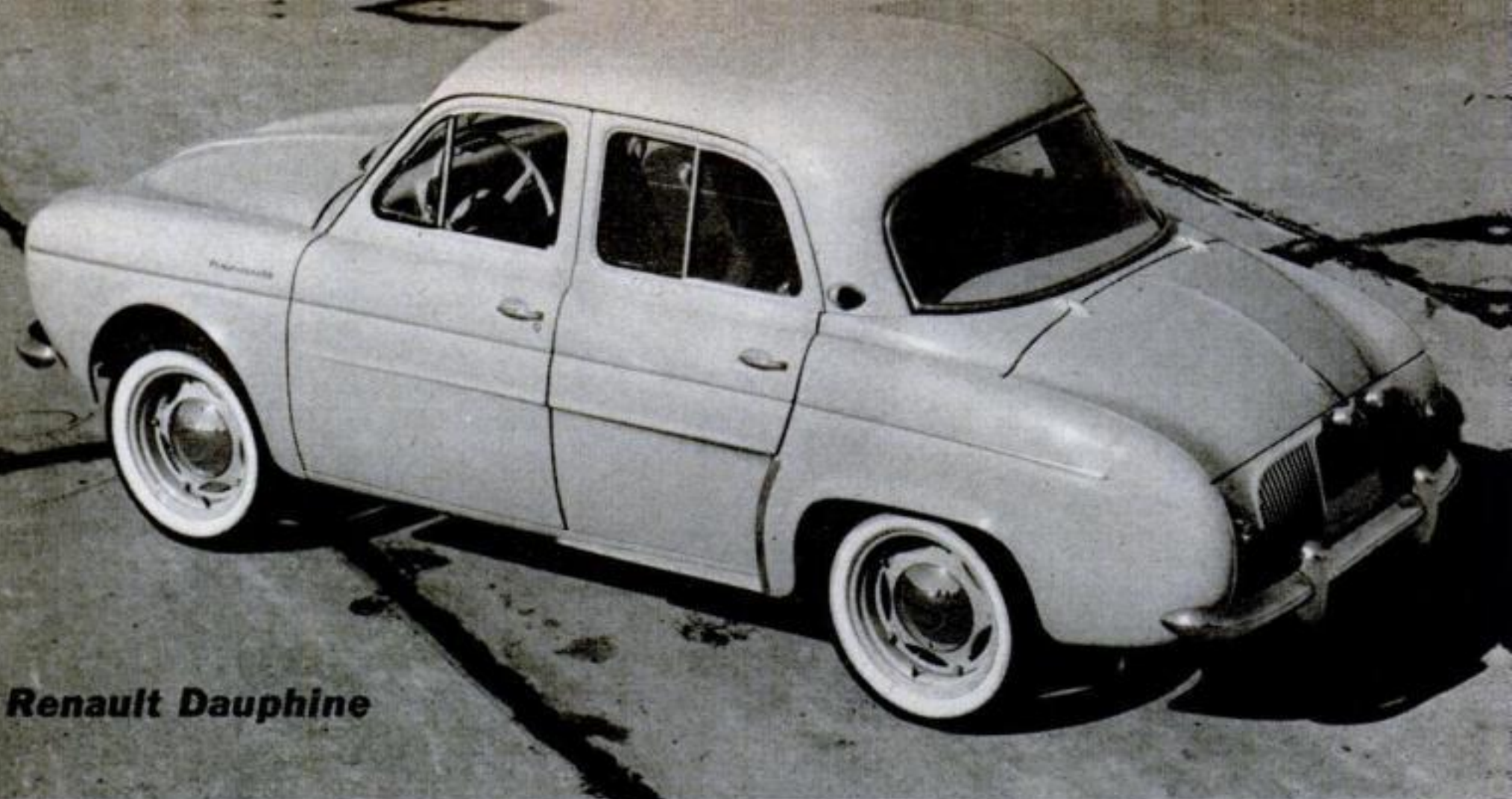
The Ghia's cornering is good, and the all-round visibility superb. The ride is comparatively hard.

Biggest seller—by far—of all the little foreign cars over here, the VW has a four-cylinder, rear-positioned, air-cooled engine that goes on and on, like the wonderful one-hoss shay.

The secret of the VW's durability lies in an engine that has been "detuned." A kissing cousin of the high-performance, and expensive, Porsche, the VW has a short-stroke piston speed of only 1,440 feet per minute wide open. With a lower compression ratio than the Porsche, a cam that helps hold top speed under 70 m.p.h., and restricted "breathing," the VW deliberately is built to wear well.

You can get cylinder heads to hot it up, as well as a supercharger, but that voids a guarantee that is double that for most U. S. cars—six months, or 6,000 miles of driving.

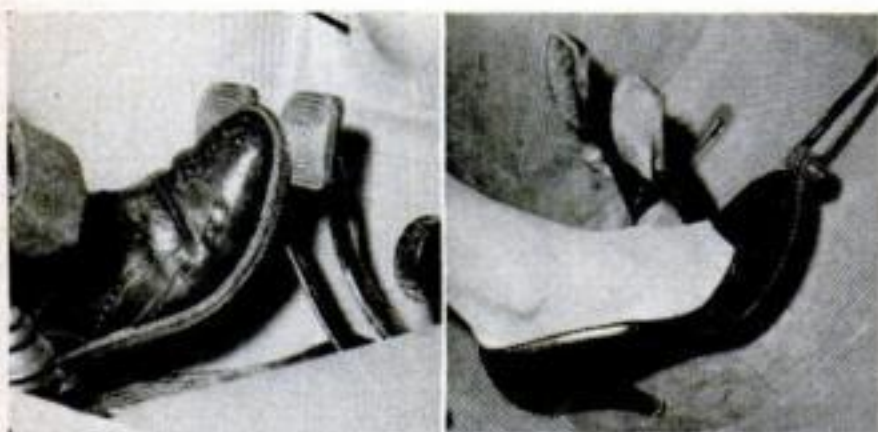
The VW's popularity in this country inevitably inspires the pranksters. Some



Renault Dauphine

FRONT HEADROOM on this French sedan beats that on both '57 Chevrolet and Plymouth, rear headroom matches them. Rear fender louvers

supply air to caboose engine, are adjustable to speed cold-weather warmup. Dauphine's curb weight is much less than VW's or Saab's.



FOOT CONTROLS on most foreign cars are too small and close-spaced by U.S. standards. Throttles, as at right, have no heel rests.

REAR-WHEEL TRACK on German one-lung job, 20.4 inches, is almost 27 inches narrower than that in front. Turning-circle diameter is only

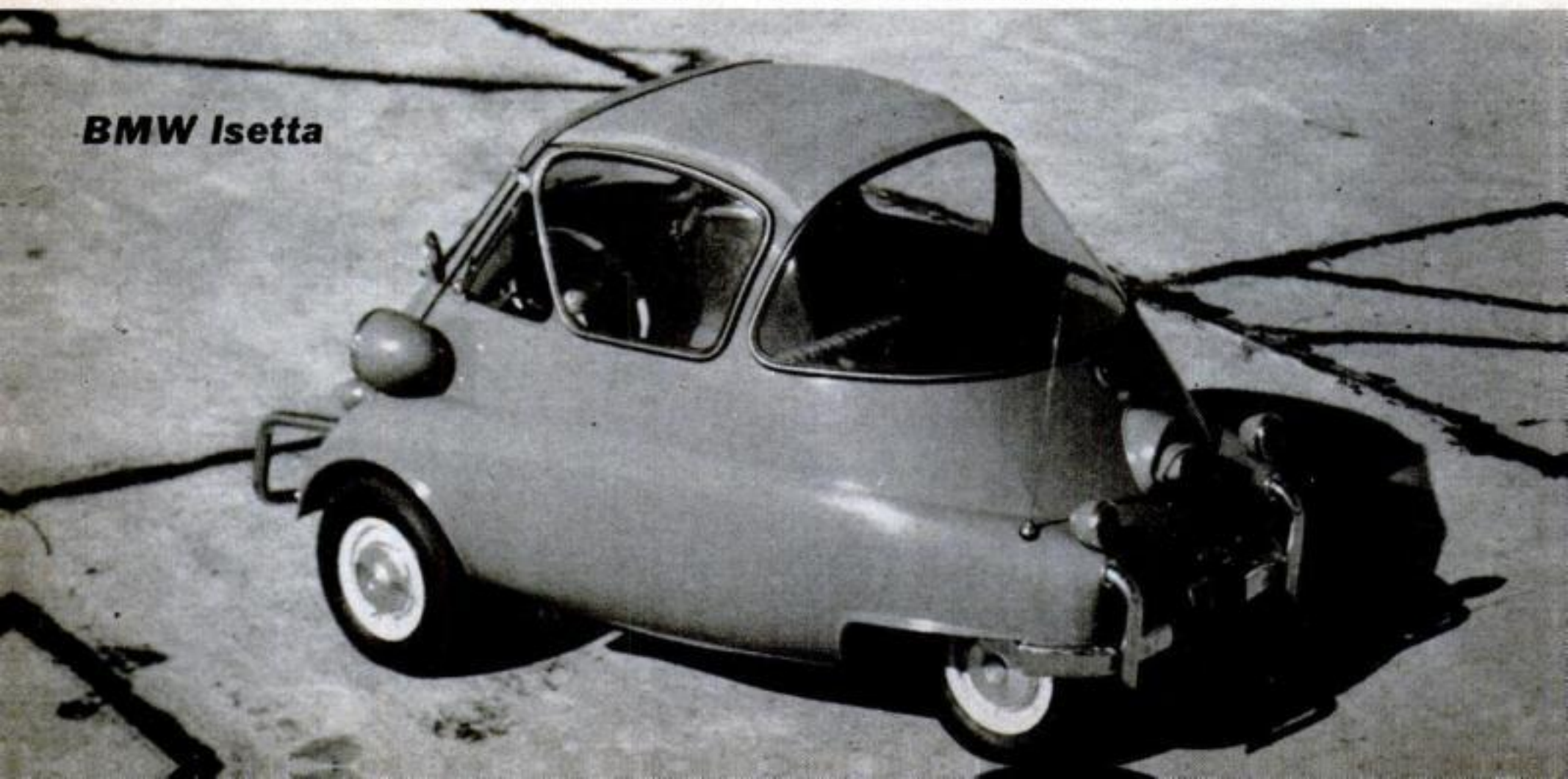
VW owners tote a sign in their windows: "Made in der Black Forest by elves."

To get a VW, you have to wait for months in most U. S. localities. As for its Ghia version you have to knock and whisper that Joe sent you.

For a report on cross-country driving in a VW, see *POPULAR SCIENCE* for September, 1956, page 144. The VW is imported by Volkswagen of America, Englewood Cliff, N. J., a factory branch.

24 feet. In Europe this car actually participates in lengthy road races. Isetta is second only to VW in the number of its U. S. dealers.

BMW Isetta





SPARE TIRE rests in a rack behind the front bumper. Hood is front-hinged. Like VW, Dauphine has four independently sprung wheels.

The Saab

The styling on the Saab is strictly out of Svenska Aeroplan Aktiebolaget, one of the more important European airplane factories. Factory engineers engineered this car *and* styled it. When the Saab was introduced in the U. S. last year, the Americans with the responsibility for selling it suggested gently that a little restyling would help over here.

The factory pondered, gravely agreed

STEERING WHEEL, hinged to Isetta's big front door, has universal joint at its base. Door is extra-solid for collision protection.



—and restyled the engine compartment.

This little car is astonishingly stable. It takes turns standing up that would scare the daylights out of you in a U. S. automobile. The car's miniature two-cycle, three-cylinder engine drives the front, not the rear, wheels, like yesteryear's Cord, through a three-speed transmission. Yet steering is easy.

Of the four cars driven by POPULAR SCIENCE, the Saab had the most comfortable ride.

Like many two-cycle jobs, the cylinders skip beats when the engine is not under load. That's because of the nature of the porting in the cylinder walls that replaces conventional poppet valves. At a given point in the piston cycle, back pressure—under light load—builds up in the exhaust. That robs the cylinder of a burnable mixture. But the engine keeps right on turning over, and the tailpipe goes *pffft-pffft-pffft*.

The engine has three cylinders, instead of two or four, because it simplifies the porting to have the rods spaced 120 degrees apart on the crankshaft. Lubricating oil is mixed with the gas.

The geometry of the suspension makes the Saab squat in back, instead of pitching forward, when braking. I didn't like sitting cockeyed, however, to reach the pedals, offset to make room for the left front-wheel well. Second gear position on the steering-column shift lever, 90 degrees higher than normal, bothered me. Nor did I like the rear visibility.

But the acceleration was good and the top speed of 78, for me, sufficient. The Saab free-wheels, at the touch of a control, to prevent bucking at low speeds.

Winner of the Great American Mountain Rallye through New England last winter, the Saab is imported by Saab Motors, New York, a factory subsidiary.

The Renault Dauphine 5 CV

This newest of the Renaults is the product of a "horsepower race" in France. The letters CV stand for chevaux, which is French for horses. By

[Continued on page 204]

See next page for foreign-car chart

JUNE 1957 63

Foreign-Made Family Cars

MAKE AND MODEL	MADE IN	LIST PRICE IN NEW YORK	ESTIMATED MAX. MILES PER GALLON	ESTIMATED TOP SPEED	ESTIMATED ACCELERATION (secs.)	HP. @ R.P.M.	LENGTH (in.)	WHEELBASE (in.)	BODY WIDTH (in.)	HEIGHT (in.)	
ANGLIA DELUXE (FORD) 2-door sedan	England	\$1,539	35	70	0-50 in 18.5	36 @ 4,400	151	87	61	59	
AUSTIN A-35 2-door sedan	England	\$1,395	42	62	0-50 in 18.5	28 @ 4,800	162	79.5	55	59.2	
BORGWARD ISABELLA 2-door sedan	Germany	\$2,350	30	82	0-50 in 15	60 @ 4,700	161.5	101.6	66	58.3	
CITROËN 2 CV 4-door soft-top conv.	France	\$1,298	55	50	0-50 in 13.5	15 @ 3,500	149	94	58.3	63	
CONSUL MARK II (FORD) 4-door sedan	England	\$2,012	32	76	0-50 in 14.1	59 @ 4,400	172.3	104.5	68.6	61.5	
DKW 2-door sedan	Germany	\$1,995	35	75	0-50 in 18	44 @ 4,250	166	96	67	55	
DYNA PANHARD 4-door sedan	France	\$2,195	46	83	0-50 in 15	50 @ 5,000	180	101.2	63	56.7	
FIAT 600 2-door sedan	Italy	\$1,445	42	58	0-50 in 38.5	21.5 @ 4,600	127	78.8	54.8	51	
FIAT 1100 2-door sedan	Italy	\$1,995	30	68	n.a.	32 @ 4,400	n.a.	n.a.	n.a.	n.a.	
GOGOMOBILE 2-door sedan	Germany	\$995	60	55	0-50 in 40	17 @ 5,000	114.5	70.3	50.5	48.6	
HILLMAN MINX 4-door sedan	England	\$1,849	30	80	0-50 in 16.5	51 @ 4,600	160.5	96	60.8	59.5	
ISETTA 1-door coupe	Germany	\$998	85	50	0-50 in 22	13 @ 5,200	93.7	58	55.5	52.6	
KARMANN-GHIA 2-door hardtop	Germany	\$2,395	32	70	0-50 in 17.1	36 @ 3,700	163	94.5	64.2	52.2	
MESSERSCHMITT	Germany	\$898	100	65	n.a.	10 @ 5,250	111	80	48	47	
METROPOLITAN 2-door hardtop	England	\$1,406	41.5	75	0-50 in 16.1	52 @ 4,500	149.5	85	61.5	54.5	
MORRIS MINOR 2-door sedan	England	\$1,599	45	82	n.a.	38 @ 4,450	148	86	61	60	
PEUGEOT 203 4-door sedan	France	\$1,995	29.8	71	0-50 in 21	58 @ 4,900	175.5	102.5	66	59	
RENAULT 4 CV 4-door sedan	France	\$1,345	50	62	0-50 in 22	21 @ 5,000	143	83	56	58	
RENAULT DAUPHINE 5 CV 4-door sedan	France	\$1,645	50	71	0-50 in 19	32 @ 4,250	155	89	60	57	
SAAB 2-door hardtop	Sweden	\$1,895	40	78	0-50 in 18	38 @ 5,000	158	98	62	58	
SIMCA ELYSEE 4-door sedan	France	\$1,675	35	75	0-50 in 13.7	48 @ 4,500	162	86.2	61.3	58.9	
SUNBEAM RAPIER 2-door hardtop	England	\$2,499	31	87	0-50 in 14.8	67 @ 5,100	160.5	96	60.8	58	
VOLKSWAGEN 2-door sedan	Germany	\$1,495	34	68	0-50 in 17.1	36 @ 3,700	160.2	94.5	60.6	59	
VOLVO 2-door sedan	Sweden	\$1,995	28	93	0-60 in 19.2	70 @ 5,500	177	102.5	62.5	61	
ZEPHYR MARK II (FORD) 4-door sedan	England	\$2,195	28	86	0-50 in 11.9	86 @ 4,200	178	107	67	60	

STATION WAGONS

ESCORT (FORD) 2-door	England	\$1,629	35	70	—	36 @ 4,500	140.8	87	60.6	62.5	
HILLMAN HUSKY 2-door	England	\$1,535	40	72	—	42 @ 4,200	145.5	84	62	61	
MORRIS MINOR TRAVELLER 2-door	England	\$1,829	40	65	—	38 @ 4,450	149	86	61	60.5	
SIMCA CHATELAINE 2-door	France	\$1,983	24.1	91	—	85 @ 4,400	177	105	68	58	
VOLKSWAGEN KOMBI 4-door	Germany	\$1,995	30	50	—	36 @ 3,700	165	94.5	67.9	76.4	

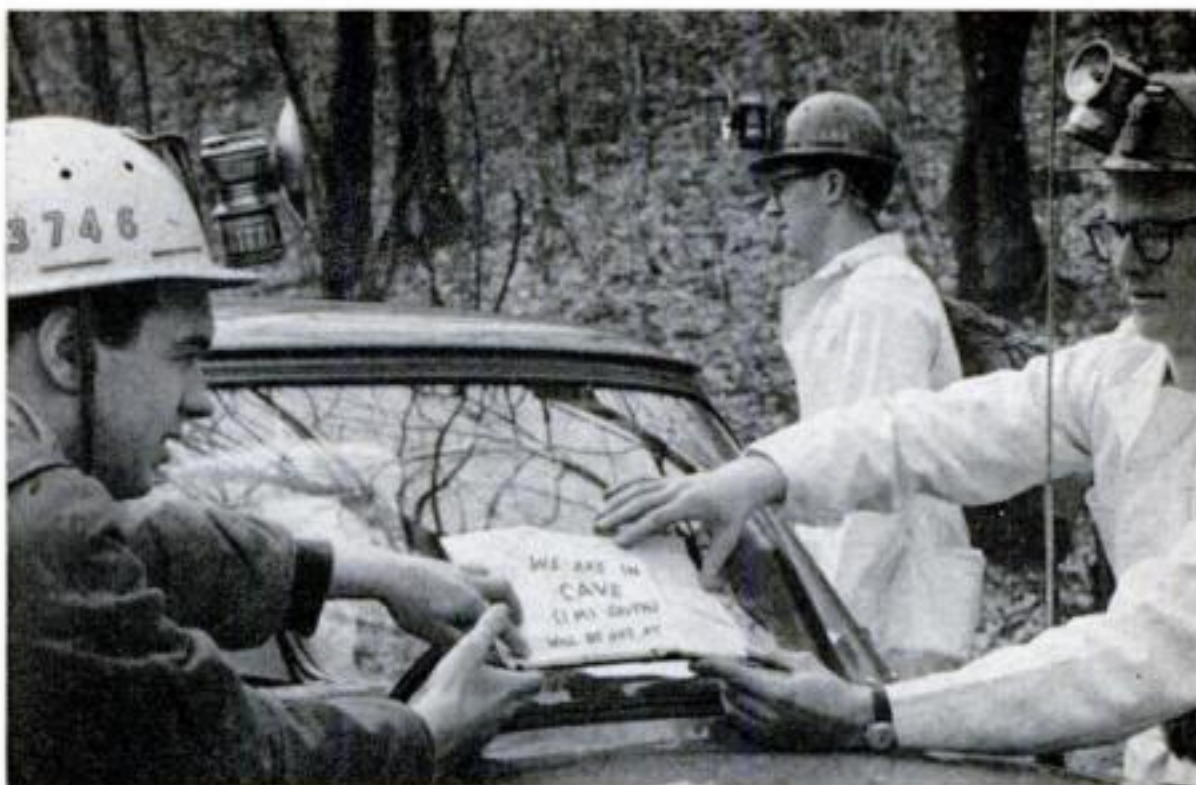
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Under \$2,500

	WEIGHT (lb.)	ADULT PASSENGERS	ENGINE	COMPRESSION RATIO (to 1)	DISPLACEMENT (cu. in.)	COOLING SYSTEM	FORWARD SPEEDS	FEATURES
	1,642	4	4 cyl., L-head	7	71.6	water	3	
	1,484	4	4 cyl., OHV	7.2	48.8	water	4	Price includes heater.
	2,204	5	4 cyl., OHV	7	14.9	water	4	Price includes heater, hydraulically operated clutch.
	1,125	4	2 opposed cyl., OHV	7	25.9	air	4	Front-wheel drive, roll-back top, centrifugal clutch. Price includes heater. Fenders bolt on; new one costs under \$10.
	2,504	5	4 cyl., OHV	7.8	103.9	water	3	Overdrive available.
	2,072	4	3 cyl., 2 cycle	7	54.1	water	4	Front-wheel drive. No valves, tappets, camshaft. Oval steering wheel for lap clearance. Clutchless shifting above first gear. Price includes heater, free-wheeling.
	1,764	6	2 opposed cyl., OHV	7.3	51.9	air	4	Front-wheel drive, hemispherical combustion chamber, torsion-bar valve springs. Price includes heater.
	1,280	4	4 cyl., OHV	7	17.5	water	4	Engine mounted behind rear axle. Rear seat folds forward for extra luggage space. Price includes heater.
	n.a.	n.a.	4 cyl.	n.a.	n.a.	n.a.	n.a.	Price includes heater.
	855	4	2 cyl., 2 cycle	6.5	8.2	air	4	Engine in rear.
	2,200	4	4 cyl., OHV	8	85	water	4	Step-down floor.
	770	2	1 cyl., OHV	7	18.3	air	4	Engine in rear. Rear tread considerably narrower than front.
	1,786	2	4 opposed cyl., OHV	6.6	72.7	air	4	Engine in rear. Price includes heater.
	485	2	1 cyl., 2 cycle	6.6	10.6	air	4	Three wheeler; single rear wheel drives. Passengers sit tandem. Transparent dome.
	1,875	2	4 cyl., OHV	7.2	90.9	water	3	Utility back seat. Price includes continental spare wheel.
	1,735	4	4 cyl., OHV	8.3	48.8	water	4	Austin A-35 engine. Price includes heater. Soft-top convertible available at same price.
	2,028	5	4 cyl., OHV	6.8	89.6	water	3	Hemispherical combustion chamber. Block drained by lever on top of engine. Worm-drive rear axle, sliding sun top, sleep-seats.
	1,100	4	4 cyl., OHV	7.3	46.5	water	3	Engine in rear. Sliding sun top, automatic electric clutch available.
	1,397	5	4 cyl., OHV	7.3	51.6	water	3	Engine in rear. Price includes heater. Sliding sun top available.
	1,808	4	3 cyl., 2 cycle	7.3	45.5	water	3	Front-wheel drive. Price includes tilt-and-bed seats, heater, whitewall tires.
	2,053	4	4 cyl., OHV	7.2	77.4	water	4	Price includes heater, whitewall tires. Other models available with V-8, 80 hp.
	2,350	4	4 cyl., OHV	8	85	water	4	Twin carburetors. Price includes heater, overdrive, tachometer.
	1,609	4	4 opposed cyl., OHV	6.6	72.7	air	4	Engine in rear. Price includes heater. Sliding sun top available.
	2,140	5	4 cyl., OHV	7.8	86.7	water	3	Twin carburetors. Price includes tilt-and-bed seats.
	2,648	5	6 cyl., OHV	7.8	155.8	water	3	
	1,932	4	4 cyl., L-head	7	71.6	water	3	Rear load capacity: 41.5 cu. ft. with rear seat down. Tailgate: conventional, but lower flap drops to vertical.
	1,932	4	4 cyl., L-head	6.7	77.2	water	4	Rear load capacity: 90 cu. ft. with rear seat down. Tailgate: side-hinge door.
	1,575	4	4 cyl., OHV	8.3	48.8	water	4	Austin A-35 engine. Tailgate: 2 side-hinged doors. Carries 6-700-lb. load.
	2,716	4	4 cyl., OHV	7.2	77.4	water	4	Tailgate: conventional. Carries 1,000-lb. load.
	2,293	8	4 opposed cyl., OHV	6.6	72.7	air	4	Engine in rear. Two doors on right side. Rear load capacity: 170 cu. ft. with 2 seats removed.

How to Climb a Mountain from Inside





CAVE EXPLORERS play safe by leaving a message for the outside world, telling where they are going, in case rescue is needed.

By Ernst Behrendt
Photos by Hubert Luckett

IT IS possible to climb a mountain once and never give mountain climbing another thought.

It is impossible to go into a cave once and ever forget it. You are dazzled by the discovery of an unsuspected world under your feet.

Caving is adventure of a special kind. In a way, it is like mountain climbing—climbing a mountain on the inside, you might say. But there is a notable difference. When you reach the top of a mountain, you are “there.” The caver has no such tangible goal. He goes on and on



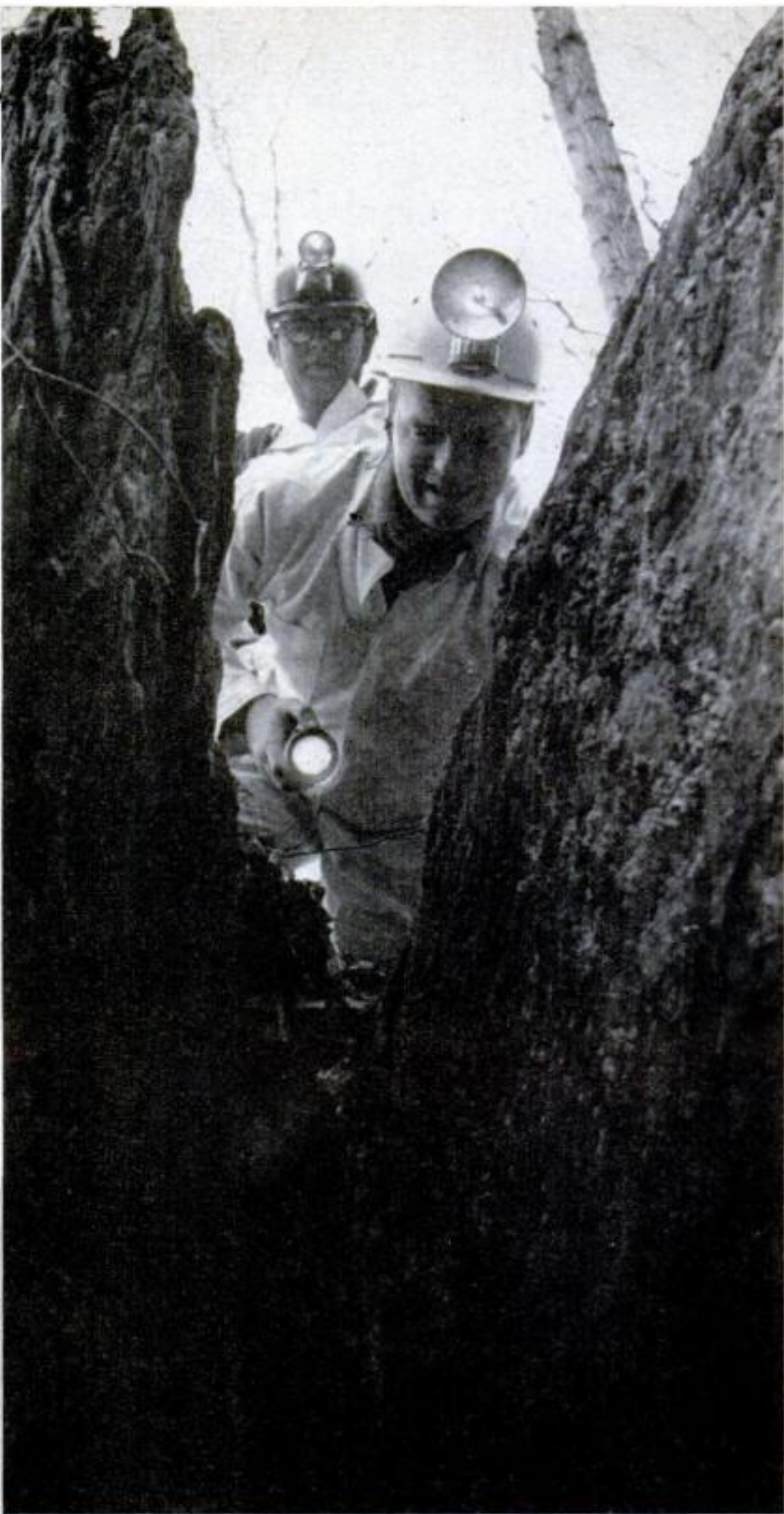
ANCHORING A SAFETY LINE, for extra protection during the descent into Indian Oven Cave, one of the exploring party drives a sharp wedge of specially tempered steel into a rock crevice.



DESCENDING A ROCK FACE, a caver uses his body as a brake while paying out the main rope. The safety line is fastened around his waist.

as long as he can squeeze through some keyhole passage, crawl down a vertical rock face or even skin-dive to the bottom of an underground lake.

He keeps going because he has a chance to set foot where no man is known to have stood before, to discover an underground cathedral of breathtak-



IN SEARCH OF NEW ADVENTURE, experienced cave explorers rarely pass up a likely looking fissure. It might lead to undiscovered wonders.

ing beauty, to photograph lace curtains of frozen rock, to marvel at pools of water so unbelievably clear that they are invisible, to collect animals unknown to science or find traces of men who lived 20,000 years ago. He can even discover a cave of his own. Five thousand American caves are known so far; there may



The first few feet are often the dizziest, but a sure rope technique breeds confidence.



Silhouetted by the light from his head lamp, a caver investigates an unfamiliar passageway.

be 50,000 more waiting to be discovered.

I recently went with a party into Indian Oven Cave, some 100 miles north of New York City and four miles from the nearest town. There were 20 of us. Ten, including me, had never been in a cave before. The youngest member of our party was a boy of 13, the oldest a man of 60.

Everybody, including the three girls, wore the same sort of outfit: coveralls, heavy boots and gloves, and a miner's helmet with a glaring cyclop's eye of a

carbide lamp affixed securely in front.

The cave's entrance lay obscurely on the wooded flank of a mountain. Our leader, Eugene Vehslage, an agile young man with a ponderous title (Chairman of the Metropolitan [N.Y.] Grotto of the National Speleological Society), pointed it out to us. We could have driven along the highway a hundred times without suspecting there was a cave there.

Halfway up the slope of the mountain,

[Continued on page 242]



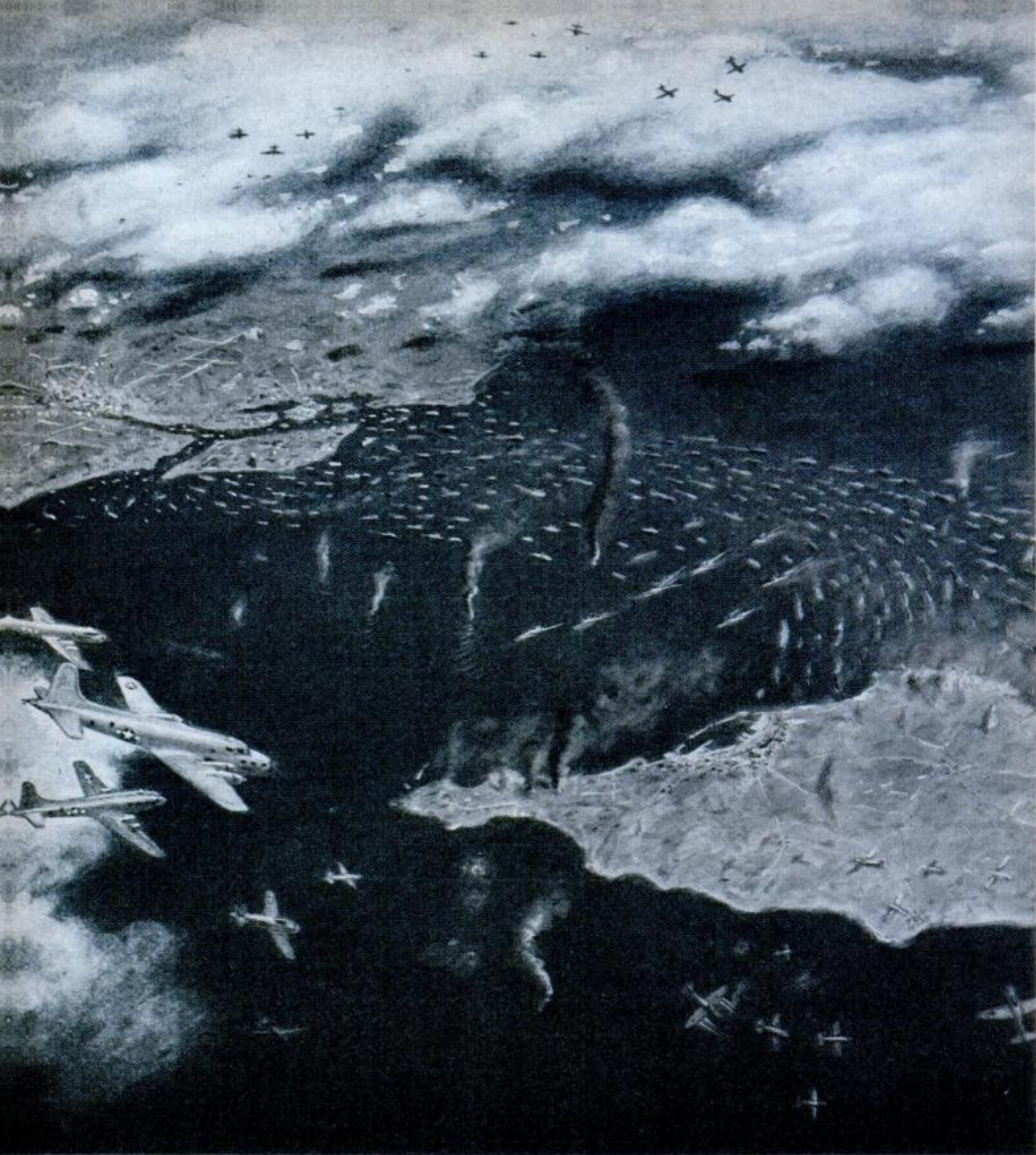
Nature's underground architecture, usually awe-inspiring, is one of the lures of caving.

EMERGING FROM A TIGHT SPOT, this man is slowly hauling himself out of a cave "crawlway."



WITH A SATISFIED SMILE, a mud-splotted caver climbs back into the upper world's sunlight.





On D-Day—June 6, 1944—when hundreds of ships and a quarter-million ground troops hit the

How Eisenhower gambled on—

History's Most Fateful Weather Forecast



beaches between Cherbourg and Caen, the weather had cleared briefly behind the cold front.

By Eliot Tozer

BY LATE May, 1944, Gen. Dwight D. Eisenhower, Supreme Commander of the Allied Expeditionary Forces, had assembled 2,000,000 men on the Channel Coast of England for the greatest seaborne invasion in

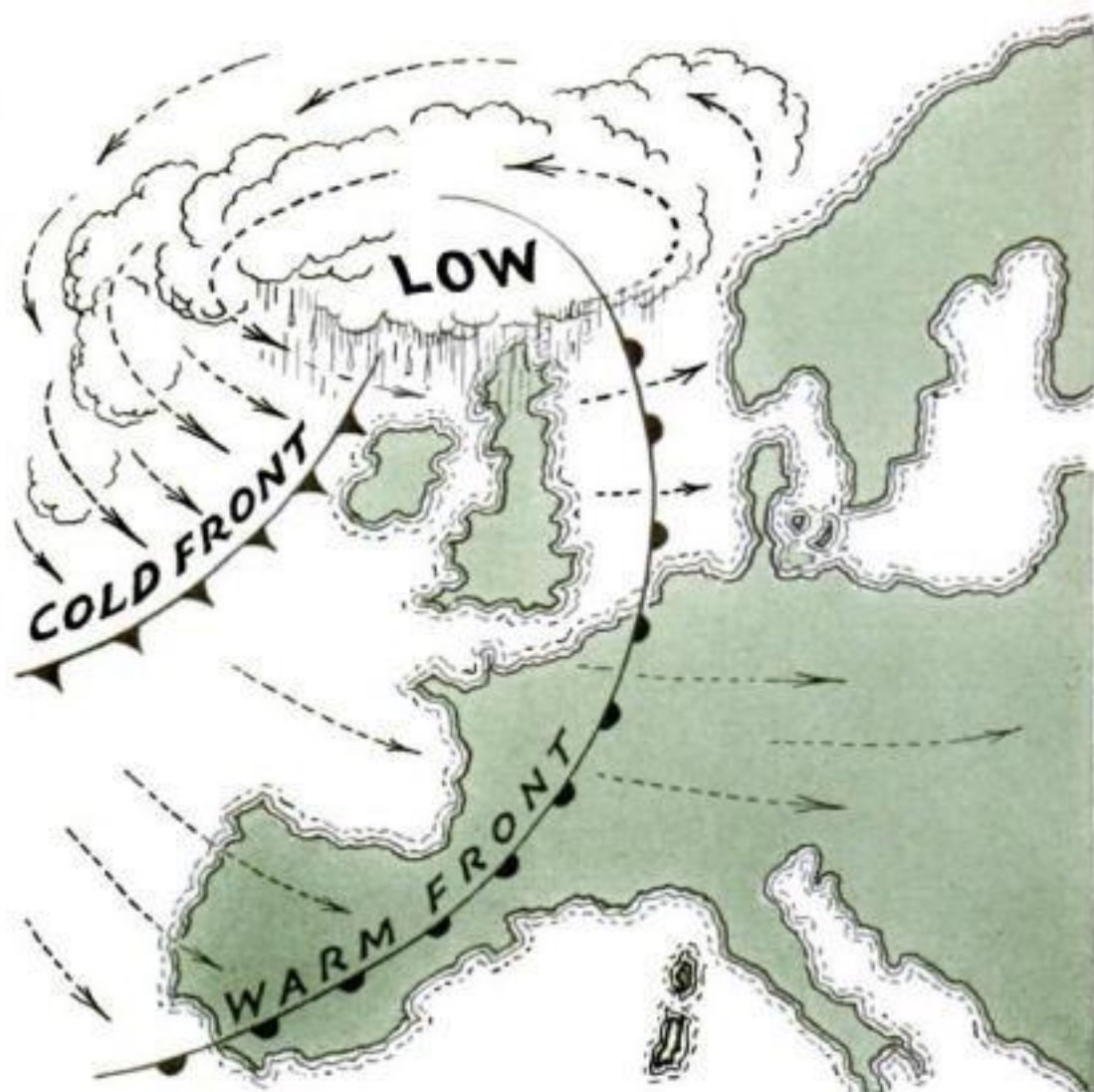
history. Over 7,500 aircraft and 4,000 ships were primed and ready to attack. D-Day was set for Monday, June 5.

For months, Eisenhower and the commanders-in-chief of the allied land, sea and air forces had sweated through dry runs of the invasion. Every Sunday morning they had studied the weather fore-

Here is how the weather picture developed in the days



JUNE 3, 1944: A low-pressure area has formed off the Shetland Islands north of Scotland. Winds swirling counterclockwise around this "low" begin to push a warm front across England.



JUNE 4: Now, as the low deepens and the wind velocity increases, a cold front builds up behind the warm front and starts to move strongly in the direction of the invasion area.

cast for 6:40 a. m. the next day and then decided whether they could successfully cross the treacherous Channel.

Weather was the most important single factor in their planning—and the biggest question mark.

Admiral Bertram Ramsay's naval forces needed winds no greater than Force 3 (8-12 m.p.h.) on shore with several days of calm preceding D-Day to minimize swells and surf.

Air Chief Marshal Sir Leigh-Mallory wanted a ceiling of 2,500 feet with at least 5/10 cloud cover to protect his paratroopers. For heavy bombers, on the other hand, he needed a cloud cover no more than 5/10 below 5,000 feet.

Gen. Montgomery's ground troops wanted dry weather; their tanks and trucks would need firm ground.

After pulling and hauling for weeks, the commanders had finally agreed on the minimum weather conditions that would be satisfactory to naval, air and ground forces.

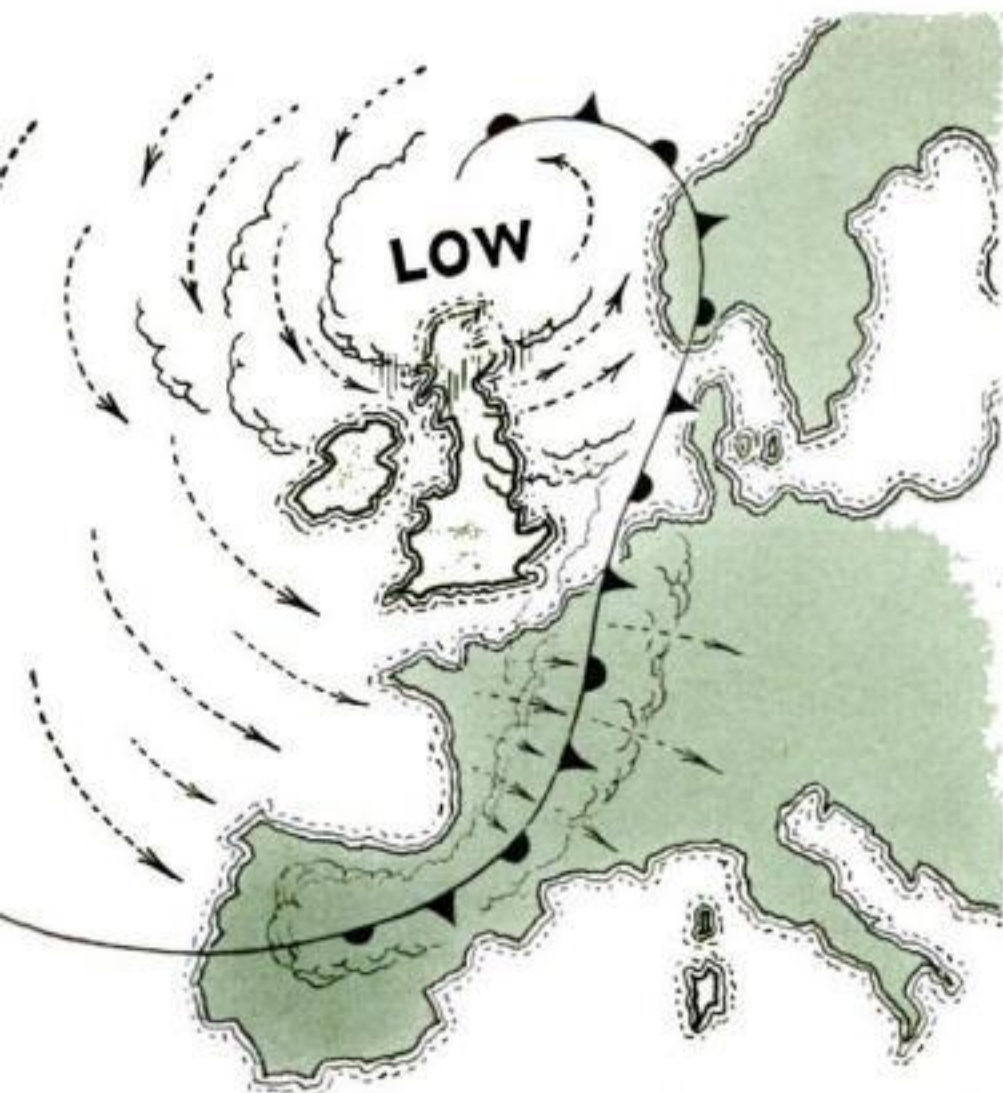
During most of May, they could have had their minimum weather. Great Britain lay under the influence of the huge high-pressure area known as the Atlantic or Azores high. Cool westerly winds spinning off this mound of clear, stable air had brought only scattered clouds.

But a crisis came on May 31. The high began to weaken. It shrank, pulling in its outer fringes, and suddenly the eternal war between cold polar air in the north and warm, moist air in the south broke out with winter-like fury. Huge waves formed where the masses met. Well-defined warm and cold fronts swept eastward. Great Britain and the continent were in for the worst June in 51 years.

8:00 a.m., June 1

At the regular morning briefing, Group Capt. J. M. Stagg, RAF, Eisenhower's Chief Meteorological Officer, was grave. "It would be impossible now to give a five-day forecast with any certainty," he said. "Even day-to-day forecasts will

immediately preceding the Allied invasion of Normandy



JUNE 5: Driven by a northwest gale, the cold front catches up with the warm front over the English Channel. This "occluded" front—where warm air meets cold—brings heavy rains.



JUNE 6: The cold front drives the warm front across the continent of Europe, the winds drop, and suddenly the skies clear briefly over the Channel, making the D-Day invasion possible.

be difficult." Unexplainably, the fronts were hanging on the coast instead of sweeping inland to dissipate.

What would the warm fronts bring, he was asked. He explained that a front is a line of demarcation between two air masses. In a warm front, warm air replaces cooler air, usually riding up over it. As the warm air rises, it cools, and moisture is wrung out as low and middle cloud, often with rain, sometimes with fog.

8:00 p.m., June 2

By telephone, Stagg called his staff together for the third of their four daily sessions. Stagg drummed the top of his desk while he waited. He knew his six forecasters would have worse than their usual heated arguments in working out a forecast now that the weather had gone bad.

He admitted that they worked under a handicap. They were scattered over a 50-mile area. The two-man American

team was attached to Gen. Spaatz' U.S. Strategic Air Forces at Bushey Park outside London. The British Air Ministry team was 50 miles away in a barracks at Dunstable. And the British Admiralty team was at Royal Navy headquarters in the city.

The two young Americans were Lt. Col. Irving P. Krick and Lt. Col. Benjamin Holzman. The Air Ministry team consisted of Sverre Petterssen, an old hand from Norway on loan to the Ministry, and his partner, C. K. M. Douglas. The Admiralty team, made up of Lieutenant Commanders Wolfe and Hogben, had the additional task of forecasting swells and surf.

At first the plan of action seemed simple. Each weather control would make its forecast independently. Then, at the appointed hours, Stagg would call them on the scrambler telephone and they would hammer out an "agreed" forecast.

But agreement came hard. The men

had been trained differently. They could not see each other's charts. Reports were skimpy; they had only 15 percent of what they needed. And often the reports were inaccurate.

And now the Friday forecast was following the pattern. The Americans predicted light northwest winds for D-Day. They expected a loop of the Azores high to reach out and blanket the Channel with clear air.

The Air Ministry, on the other hand, predicted increasing southwest winds and low clouds because of the low-pressure area that was forming off the Shetland Islands. The Air Ministry also pointed out another depression east of Greenland.

The final agreed forecast: non-operational weather for Sunday the 4th and Monday the 5th.

9:30 p.m., June 2

In the bleak War Room at Allied Naval Headquarters at Portsmouth, the commanders frowned as they listened. What was causing the strong southwesterly winds, they asked.

"A low-pressure area is forming off the Shetlands," said Stagg. "It's like a saucer-shaped hole in the atmosphere with the winds swirling around it counterclockwise. The deeper the low becomes—that is, the more the pressure drops—the faster the winds blow." Again, for some unknown reason, the storms with the lows were as severe as winter storms.

9:30 p.m., June 3

The time for decision had come. Stagg looked out over the silent commanders-in-chief. "Monday will be non-operational," he said.

During the day, the Shetlands low had moved to Northern Scotland. A warm front had formed on it and was already moving across England. There would be strong southwest winds and low clouds along the front.

Eisenhower tentatively postponed the invasion, reserving his final decision until 4:30 the next morning.

4:30 a.m., June 4

In the War Room, Stagg shook his head. "The warm front is moving very slowly. Pressure is dropping at Blacksod, Ireland. We predict that the Scottish low will continue to deepen, bring the southwest winds that were forecast last night."

Reluctantly, Eisenhower postponed the invasion until Tuesday, June 6. Destroyers steamed out through the chop to intercept the ships that had left the northern ports hours before. Paratroopers piled out of their gliders at bases in central England. The ponderous machinery of assault ground to a stop.

Now the pressure was on. Time was running out. One of the five days chosen for the invasion had slipped away.

The commanders-in-chief had agreed that the main forces should approach the coast in darkness, that the Navy should have daylight long enough to pound the coast with her big guns, and yet that the enemy should not be given time to recover from the night raids by the RAF heavies.

Most important, the massive movement could hit the beaches only within the 30-minute period after half-tide. From low tide on, demolitions experts would be clearing lanes through the steel pilings that had been set up to rip the bellies of our landing craft.

Their conditions could be met only at dawn on June 5, 6 and 7, or June 19 and 20. The meteorologists had to predict—36 hours ahead—whether the weather would meet the minimums on those dates.

Then came a break. During Saturday night, June 3, the Americans had discovered off Iceland a "bubble" of clear air in which the pressure was rising. It was in the "saddle" between the fast-developing Scottish and Greenland lows. If it continued to grow, it might spill out and wash over England, clearing the skies.

And now on Sunday morning, a cold front suddenly formed in front of the bubble, giving it shape and definition. The front anchored its northern end to the Scottish low. As the low deepened,


[Continued on page 210]

Look What They're Doing to Batteries

New dry cells, some only button-size, are sparking a revolution in power and freeing electrical products from cords.

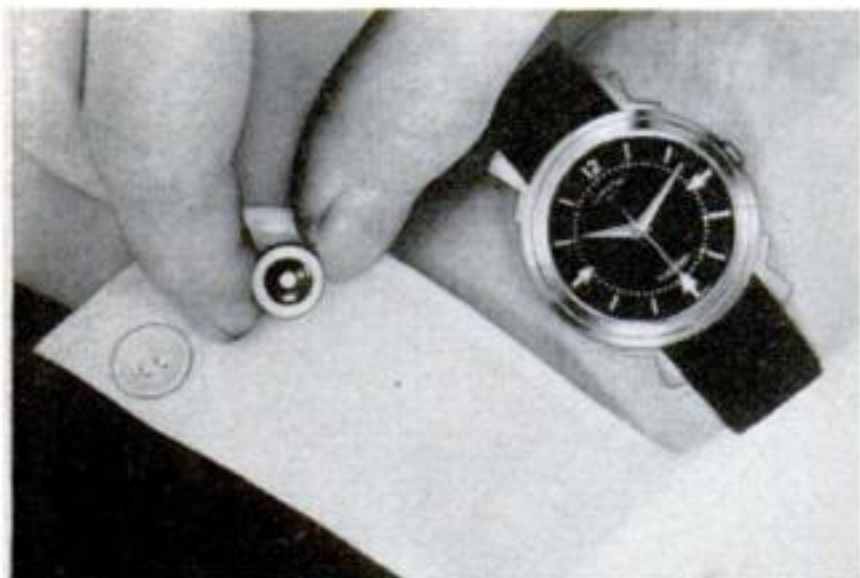
By Lloyd Stouffer

I HAVE on my wrist a watch that has no mainspring and has never been wound. But it has been keeping time since August, 1955, with the astonishing accuracy of 99.998 percent. A product of the Hamilton Watch Co., it is the world's first electric watch. After 10 years of development and testing, the company claims for it the highest ac-



The pencil points to one of the 15 tiny dry cells that, stacked in a column, wrapped tightly with plastic and capped in a leakproof aluminum tube, form the 22½-volt Burgess battery lying in the palm of the hand. It powers pocket radios, Geiger counters and several other small electronic devices

Button-size battery runs wrist watch



Between thumb and forefinger is the gold-plated dry cell that powers the Hamilton watch beside it, taking the place of a mainspring

Tiniest hearing aid needs no wires



A battery smaller in diameter than a dime is teamed with an incredible number of other little parts in this Sonotone hearing aid that fits in the ear

curacy and dependability ever achieved in a wrist watch.

A friend of mine wears a new all-in-one transistor hearing aid that will amplify sounds 400 times, but it is so tiny that it fits entirely within his ear. Developed by the Sonotone Corp., it looks about the size and shape of a man's thumbnail, weighs half an ounce, and is so cunningly contoured to the wearer's ear inside that it cannot, in any normal activity, be shaken loose, despite the absence of external support.

These are just two of the newest and most extreme examples of technical discoveries made possible by a tiny dry-cell battery, smaller than a shirt button, which works, basically, like the cells in your flashlight.

In combination with the transistor—the tiny element that is rapidly replacing many types of tubes in radios and other electronic circuits—it can sometimes do amazing jobs. Miniature batteries today

power tiny motors in toy trains and trucks, pocket wire recorders, movie cameras, cordless wall clocks and electric shavers. Automobile manufacturers are interested in a self-contained dashboard clock which can slide into the instrument panel like an ash tray, without connection to the car's electrical system.

Thanks to transistors, battery-powered pocket radios are sweeping the country; policemen and soldiers carry radio receivers and even transmitters in their caps or helmets; doctors are paged in hospitals by a signal received in their shirt pockets; highway danger flashers operate independently of electric power lines, and emergency mine telephones can function in disaster areas without fear of an explosive spark.

Four years of exacting research by the National Carbon Co. made the battery in my watch possible and practical. The little gold-plated button is basically the same carbon-zinc cell made under National Carbon's Eveready brand name for flashlights. In terms of space occupied, it is rated 400 times more efficient than a mainspring. Long life despite its miniature size is made possible by ultra-precision manufacture. The tiny "motor" in the watch drains current at a fantastically low rate. The battery in my watch has been replaced only once, after 15 months, at a cost of \$2 and a few minutes' time.

The components of the watch motor are so small they can be observed only under a magnifying glass. Theoretically, the watch would run for 20 years on the amount of electrical energy that would light a 100-watt bulb for only one minute. The battery is actually discharging current only one percent of the time, but in a year it opens and closes the circuit more than 75 million times.

Unlike the conventional "automatic" watches that depend

upon the activity of the wearer to keep a mainspring wound, this watch will still keep close to perfect time if laid on a dresser for a year. And so positive is Hamilton that the battery will not leak and corrode the watch, that it has a standing guarantee of a new watch should this occur. The current waterproof, shockproof model with a solid gold case retails for \$175; soon there will be a gold-filled model at \$89.50, and it is expected that further progress in miniaturization of parts will eventually produce a ladies' watch.

Sonotone's transistorized all-in-the-ear hearing aid may be the ultimate example of miniaturization in personal, wireless communications. In the incredible space of one-third of a cubic inch, it packs 81 sub-miniature parts including three transistors, each about as big as a match head, three capacitors, and a battery which is a quarter of an inch smaller in diameter than a dime and about $2\frac{1}{2}$ times the thickness. Tinted to match flesh tones or hair colors, it is nearly invisible in men, and in women can be completely concealed by the hair. Fitted and serviced, it costs approximately \$250. This hearing aid, and others, by companies now making progress toward the same goal, represent a new opportunity for an estimated 3,500,000 Americans who need aids but have resisted wearing them because of appearance.

The battery used by Sonotone has an average operating life of 50 hours and costs 28 cents to replace. It differs from the cell that powers the Hamilton watch in that it uses mercuric oxide instead of manganese dioxide as one of its essential chemicals. It is simply a miniaturized version of the larger mercury battery, which has been the favored power unit for hearing aids because it will yield more energy, at a uniform voltage, size for size, under steady drain conditions. The hearing aid, of course, requires a much heavier continuous flow of current, or amperage, than does the simple, intermittent motor in the watch.

In radios, the tiny transistor is just a bit of synthetic mineral much like the "crystal" with which high-school boys 35 years ago built low-powered tubeless sets. But these rudimentary crystals had no amplifying power, and the sound usually could be heard only through earphones. Then came radios with loudspeakers, which depended upon bulky "A" and "B" batteries to heat the tubes and provide amplifying power. It was a great day, finally, when sets with built-in transformers could be plugged into house current.

Now they're back to crystals and batteries—but with immensely amplified power, clarity and long life, in the new, increasingly popular pocket-size transistor radios. And some manufacturers have ready for introduction larger table models which, they predict, within three to five years will eliminate the plug-in type.

These new table-model transistor sets will have bigger speaker and something close to hi-fi tone. A carbon-zinc battery measuring about 8 by 3 by $1\frac{1}{4}$ inches is designed to provide 900 hours of intermittent service. With improve-

Radio station can be hidden on body



Marilyn Monroe holds the midget broadcasting station, made possible by little batteries, that interviewees on Ed Murrow's "Person to Person" TV show usually tuck away in their clothes

ments in construction this will shortly be stepped up to 1,500 hours, providing enough reserve for more than a year's use four hours a day.

In the past, dry-cell batteries, as distinguished from storage batteries, have not been considered rechargeable. But General Electric has just placed on the market an all-transistor pocket radio using two penlight-size nickel-cadmium dry cells which can be recharged up to 200 times, for an advertised total life of 10,000 hours. Through a mechanism built into the carrying case, the chemical action of nickel-cadmium cells can be reversed and the exhausted elements restored. It is only necessary to plug the set into the carrying case and the case into house current overnight.

Moreover, the two nickel-cadmium cells, which may retail for replacement at about \$2.25 each, if recharged and used for 10,000 hours would cost only 45 *one-thousandths* of a cent per hour!

Today's miniaturization techniques are making possible all sorts of variations on the small, personal transistor radio. Atlantic City has experimented with receiving sets built into the peak of boardwalk patrolmen's caps. Designed by Lawrence Smith, the department's own radio technician, the sets fit inside the

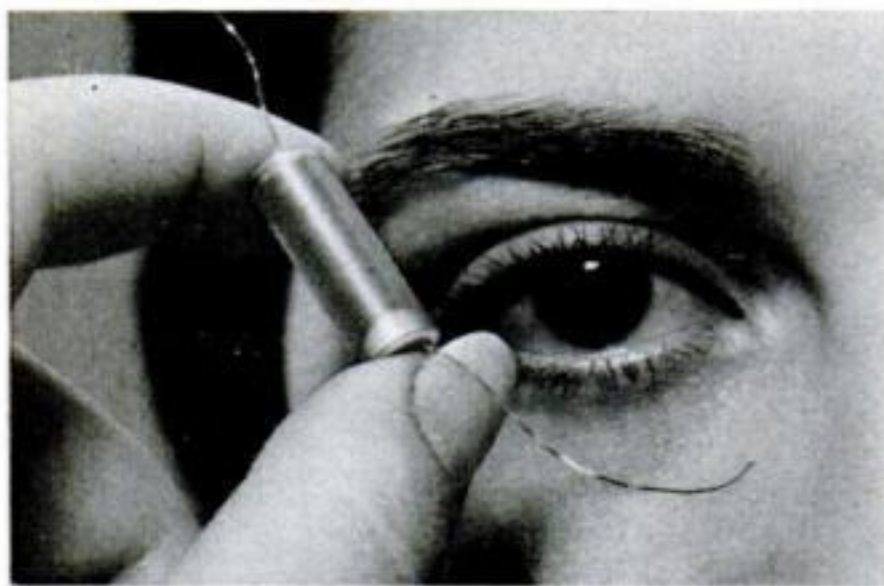
peak right behind the badge, and have one penlight cell and one miniature 30-volt "B" battery stowed in the cap's lining at the back. With an aerial that bends from front to back across the top of the hat, these sets have a range of 25 miles.

A similar receiver built into the helmet of the Cleveland Browns' quarterback enabled Coach Paul Brown to broadcast instructions from the bench last fall—until opposing teams got receivers and intercepted the messages. A league ruling later outlawed the device, but recently the Signal Corps at Fort Monmouth, N. J., devised a similar helmet which may enable the U.S. infantryman of the future to be individually wired for two-way sound.

Ever wonder how the subjects of Ed Murrow's "Person to Person" television show can be heard so clearly as they wander upstairs and down, with no microphones or trailing wires in evidence? The answer is a battery-powered broadcasting station so small it can be entirely concealed in the subject's clothing. The effective range, of course, is usually no more than 500 feet—just enough for the voice to be picked up by a receiver on the scene and then amplified for transmission.

Short-range broadcasting has found a highly useful application in "silent" paging systems now used in many factories, stores and hospitals. In Beth Israel Hospital in Boston, for example, some doctors carry in their shirt pockets transistor

This mighty mite packs 95 volts



The miniature battery shown above, which is being made by General Electric, not only delivers an astounding 95 volts, but company engineers predict it will be able to do so 20 years from now

[Continued on page 232]



How to Buy a Room Air Conditioner

How big a one do I need? What will it cost to buy and run? What about installation, power supply? Here are the facts.

By Martin Mann

REMEMBER when the badge of the well-equipped household was a TV antenna on the chimney? Now it's the coldbox protruding from a window. Last year 1,000,000 people hit their bank accounts for room air conditioners. In 1957, 1,200,000 more are expected to join the club.

Should you? The new room-cooling machines are efficient and exceptionally dependable. The price is not bad. And this year, for the first time, manufacturers specify actual cooling capacity.

Which one? Besides cooling capacity, a smart buyer needs to know price, installation problems, cost in electricity, air-moving capacity, and degree of noisiness. POPULAR SCIENCE has collected detailed specs (pages 84-85) on 73 models of 15 brands (there are many more of

comparable quality on the market, of course). Our chart lists only window units rated at $\frac{3}{4}$ and one horsepower, since these are by far the most popular sizes.

How much? It ought to be less than the mythical "list" price specified in the chart—how much less depending on how good a haggler you are and how good a salesman the dealer is. Some manufacturers won't specify list price at all. It is useful in one way, however, since it lets you sort out the stripped, standard and deluxe models in each brand.

Some discount houses—especially if overstocked—may offer a good buy. Don't overlook the department stores, though—many of them now meet (or beat) the discounters' prices.

There's one price gimmick you ought to know about. It involves the Federal Excise Tax. Uncle Sam puts this 10-per-

cent bite only on conditioners rated at $\frac{1}{2}$ horsepower or less. There is no FET on units of one horsepower or more. The FET comes to just about the difference in manufacturing cost between a $\frac{1}{2}$ -horse and a one-horse model. That's why you may find $\frac{1}{2}$ - and one-horse units of equal quality selling for the same price. Still, don't buy the bigger air-conditioning unit unless you need it, for reasons that are explained below.

How much coolth? An air conditioner doesn't really manufacture cold, but pumps heat—from inside your room to the outdoors. So what you want to know most is: How much heat can it pump?

Beginning with the '57 models, the manufacturers tell you this, in British Thermal Units (BTUs) per hour. Until this year, air conditioners were rated by the equivalent to tons of melting ice, or by the horsepower of their motors. Horsepower doesn't mean much: Some $\frac{1}{2}$ -horsepower units can pump nearly as much heat out as some one-horsepower units. Choose a unit by its cooling capacity in BTUs per hour, not by its horsepower.

The PS chart lists the cooling capacity for each unit. The figure given is the standard one—95° temperature, 50 percent relative humidity outdoors; 80° temperature and 56 percent relative humidity inside the cooled room—and is the rating you should find in the manufacturer's specifications. These rated cooling capacities have been measured in accordance with requirements set up by the Air Conditioning and Refrigeration Institute.

In judging a conditioner's ability to deliver what it claims, note the compressor capacity. This tells you the size of the compressor—how much refrigerant it can pump each minute.

How much cooling capacity do you need? That depends on just about everything from the number of people using the room to the location of shade trees outside. Very roughly, 5,500 to 6,000 BTUs per hour will take care of a room as large as 400 square feet under very

How an air conditioner cools your room

.....

TWO SCIENTIFIC PRINCIPLES make the process of air conditioning possible: first, when a liquid changes to a gas it absorbs heat, and when a gas changes to a liquid it releases heat; second, varying the pressure varies the temperature at which these changes take place. An air conditioner thus compresses gas so that it will change to a liquid, releasing heat outdoors. Then it reduces pressure so that the liquid will change to a gas. In doing this, the liquid absorbs heat from indoors. Thus the conditioner picks up heat from the air inside the room and throws it off into the air outside the house.

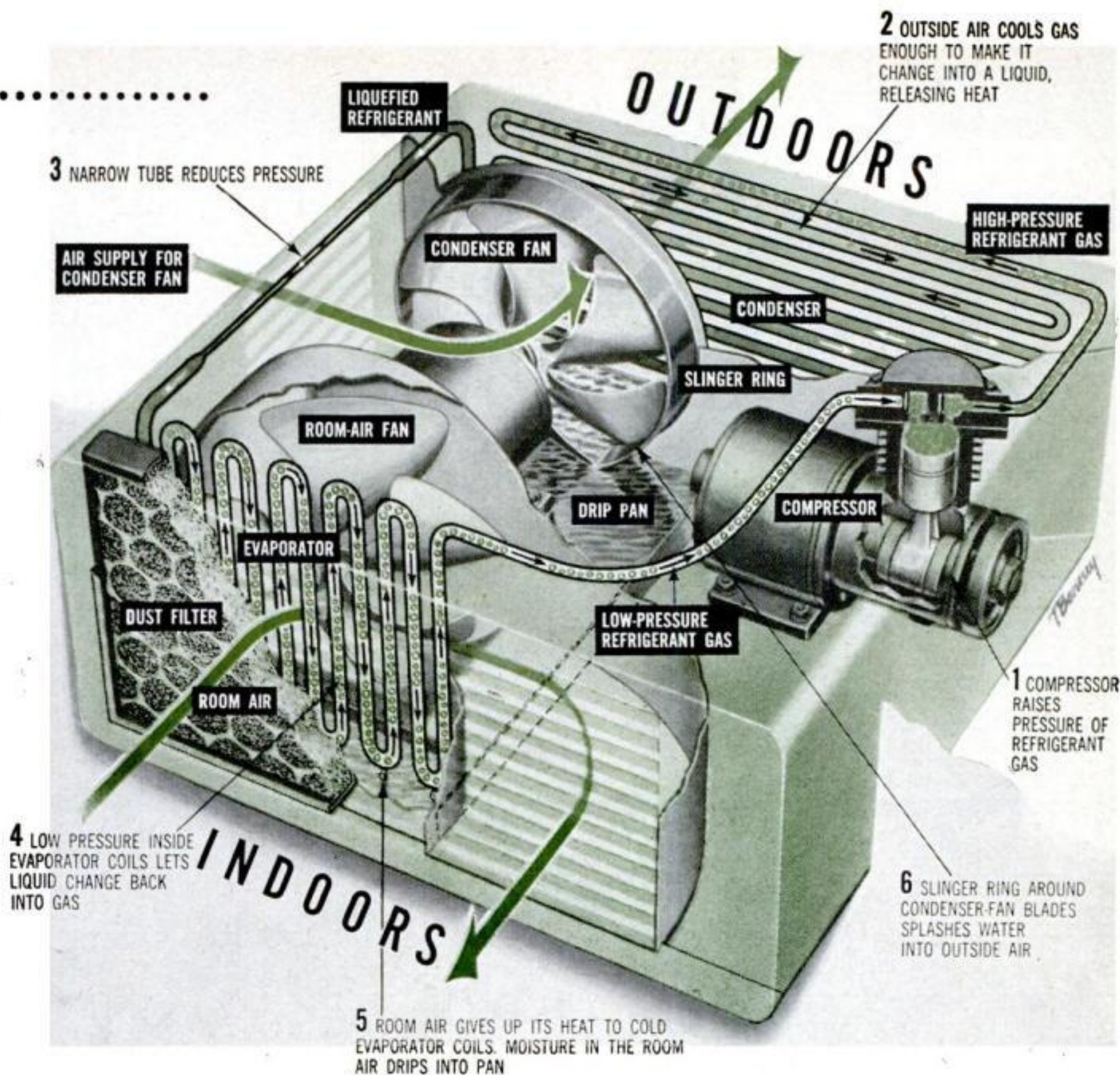
favorable conditions; and 8,000 BTUs per hour will handle up to 500 square feet. You can figure out exactly what is required for your room by filling in the table at the end of this article.

Dehumidifying capacity. It's the humidity, all right, that makes summer so mean. An air conditioner does something about that. It cools by pulling air over very cold coils, and moisture in the air condenses on those coils—the same thing that happens when cold-water pipes sweat. The air that the conditioner blows back into the room is quite dry, which contributes a lot to making you feel comfortable.

The PS chart specifies how much water each air conditioner can remove from the air per hour. Since it's unlikely that you'll ever make the room air too dry—if you live in a humid area—the more dehumidifying capacity the better.

This dehumidifying action is the reason why you should get an air conditioner with cooling capacity just right, or even a shade small, for your room. A unit that is too big will run for a short time, then shut itself off for quite a while—it cools the room quickly. The long off periods don't matter much so far as cooling is concerned, since rising temperature will turn the unit on again. But humidity increases faster than temperature. And your room will become uncomfortable from excess humidity during the long off cycles.

Air circulation. The chilled and dried inside air has to be sent around the



room. And outside air must be blown over the condenser coils. This calls for two fans. You'll want to know:

- The size and speed of the motor, which drives both fans. Deluxe models offer two speeds (the slower speed is quieter).

- The actual air-moving capacity for each job the fans do. In lower-priced conditioners, the inside fan only recirculates room air through the cooling coils, but more expensive models can be set to take in some fresh air from outdoors or pull stale air out of the room.

Most air conditioners have adjustable grilles, so that you can control to some degree the direction of the air flow. One,

Mitchell's Roto-Cone, has a grille that turns with the air stream to spiral air around the room.

Air filter. The most effective (and most expensive) is the electronic type, which catches very fine dust and allergy-causing pollen (as small as 1/25,000 inch) in a high-voltage trap. Philco's version, which is slightly different from the others, releases negative electrical charges into the air, a process that some doctors think benefits those who suffer from hay fever.

Unless dust or pollen allergies are a serious problem for you, standard mesh filters will probably do. The metal and plastic types can be washed off when

	MAKE	MODEL	PRICE	COOLING CAPACITY (BTU per hour)	DEHUMIDIFYING CAPACITY (pints per hour)	COMPRESSOR PUMPING CAPACITY (cu. in. per min.)	FAN MOTOR			CONDENSER FAN CAPACITY (cu. ft. per min.)	(cu. ft. per min.)		
							HP	R.P.M. (high)	R.P.M. (low)		RECIRCULATION	FRESH AIR	EXHAUST
THREE-QUARTER HORSEPOWER	ADMIRAL	75U7 75M7	\$250 \$290	6,150 6,150	1.2 1.2	2,554 2,554	1/30 1/30	1,085 1,085	none 975	450 450	260 260	none none	none 55
	AIRTEMP	1675-12 1875	\$310 \$360	6,300 7,500	2.8 4.4	2,590 3,420	1/20 1/30	1,050 1,050	none none	445 400	215 290	none 40	none 110
	AMANA	75-LD2M Deluxe 75-A2M Year 'Round 75-LF2M Slim-Lo	\$300 \$360 \$370	n.a. n.a. n.a.	1.6 2.3 1.6	2,590 3,410 2,590	1/15 1/15 1/15	1,050 1,050 1,050	none 850 850	440 390 400	270 295 275	none 100 80	none 80 80
	CARRIER	Starline Crestline Super Crestline	n.a. n.a. n.a.	7,500 7,500 7,500	1.5 1.5 1.5	n.a. n.a. n.a.	1/12 1/12 1/20	1,050 1,050 1,140	none 950 1,040	n.a. n.a. n.a.	280 280 300	n.a. n.a. n.a.	none n.a. n.a.
	FEDDERS	Deluxe Custom Supreme	\$290 \$385	7,800 7,000	2.2 2.0	3,500 2,600	1/18 1/15	1,080 1,075	945 950	550 500	300 300	80 80	70 80
	FRIGIDAIRE	AE 75-57 AE 75S-57	\$350 \$350	8,200 6,500	2.3 2.3	3,294 3,795	1/12 1/12	1,140 1,140	none none	465 465	270 270	120 120	75 75
	GENERAL ELECTRIC	R 51P-16 R 41P-16 R 52P-16	\$320 \$340 \$350	7,500 6,600 7,700	2.1 1.2 2.1	3,364 2,554 3,364	1/12 1/30 1/30	1,050 1,100 1,100	none none none	450 450 450	245 255 245	85 85 65	none none 100
	KELVINATOR	RCG-78RS	\$330	6,775	1.0	2,554	1/12	1,050	none	n.a.	320	none	50
	MITCHELL	M-557 Power Pac M-257 Roto-Cone M-357 Imperial	\$340 \$390 \$470	n.a. n.a. n.a.	2.5 2.5 2.6	2,967 3,354 3,354	1/10 1/12 1/10	1,550 1,050 1,050	none none none	560 570 650	280 285 325	80 80 100	none 90 175
	MONTGOMERY WARD	5777 Custom 75 5797 Supreme 75	\$220 \$240	6,600 6,600	3.0 3.0	2,590 2,590	1/15 1/15	1,000 1,050	none 900	450 450	300 350	50 70	35 120
	PHILCO	A873-2	\$270	n.a.	1.6	2,554	1/10	1,100	none	560	295	95	none
	RCA WHIRLPOOL	DP-775-2 IP-775-2 Imperial	n.a. \$330	n.a. n.a.	2.0 2.0	n.a. n.a.	1/15 1/15	1,060 1,075	920 920	n.a. n.a.	275 300	none 70	none 80
	VORNADO	L 75C-1	\$330	6,775	1.0	2,553	1/12	1,050	none	n.a.	320	none	50
	YORK	E 75 E 75L E 75AP	\$330 \$350 \$400	7,500 6,250 7,500	2.0 1.3 2.0	3,318 2,402 3,318	1/12 1/10 1/6	1,040 1,050 1,025	none none 950	500 500 420	300 270 280	100 110 75	75 75 75
ONE HORSEPOWER	ADMIRAL	100 U12 100 M12 100 M23	\$270 \$310 \$320	8,900 8,900 10,100	1.6 1.6 2.3	3,640 3,640 4,725	1/20 1/20 1/12	1,085 1,085 1,050	none 975 930	500 500 500	300 300 320	none none none	none 70 75
	AIRTEMP	1600-14 1600-10 1800	\$290 \$330 \$380	8,000 9,100 9,000	4.0 4.2 5.5	3,690 4,240 4,240	1/12 1/10 1/20	1,550 1,050 1,050	none none none	635 450 400	235 370 325	none none 50	none none 120
	AMANA	Deluxe Year 'Round Slim-Lo	\$330 \$380 \$400	n.a. n.a. n.a.	2.7 2.7 3.3	3,690 3,690 4,800	1/12 1/8 1/12	1,100 1,350 1,100	none 1,250 900	375 500 450	285 375 300	none 120 100	none 100 100
	CARRIER	Starline Crestline Super Crestline	n.a. n.a. n.a.	9,600 9,600 9,600	2.0 2.0 2.0	7,100 n.a. n.a.	1/10 1/10 1/12	1,050 1,050 1,140	none 950 1,140	n.a. n.a. n.a.	310 310 325	n.a. n.a. n.a.	none n.a. n.a.
	FEDDERS	Deluxe Custom Custom Supreme	\$300 \$370 \$380	9,700 10,600 9,100	2.5 3.0 2.5	4,800 4,800 3,700	1/8 1/6 1/12	1,100 1,100 1,080	950 950 950	550 500 500	340 350 340	140 145 140	165 170 165
	FRIGIDAIRE	A 100-57 AE 100S-57 AE 100-57	\$325 \$365 \$365	9,000 9,100 10,000	2.8 2.8 2.8	6,607 3,795 6,607	1/8 1/8 1/8	1,140 1,140 1,140	none none none	510 510 510	300 300 300	none 140 140	none 90 90
	GENERAL ELECTRIC	R 61P-16 R 71P-26 R 72P-26	\$340 \$350 \$380	9,000 10,100 10,100	2.5 2.9 2.9	3,640 4,727 4,727	1/20 1/20 1/20	1,600 1,550 1,550	1,350 1,250 1,250	625 174 540	310 310 310	145 95 70	none none 130
	KELVINATOR	RCG-108R RCG-109W	\$320 \$369	9,340 10,040	3.5 2.3	4,735 4,735	1/10 1/8	1,050 1,530	none n.a.	n.a. n.a.	400 375	none 55	70 75
	MITCHELL	M-5057 Power Pac M-2007 Roto-Cone	\$360 \$400	n.a. n.a.	3.2 3.5	4,713 4,713	1/10 1/8	1,500 1,050	none none	700 550	350 300	100 100	90 90
	MONTGOMERY WARD	5167 Custom 100 5177 Custom 101 5197 Supreme 101	\$220 \$230 \$250	8,700 9,500 10,800	3.3 3.5 3.5	4,800 4,800 4,800	1/12 1/12 1/12	1,000 1,000 1,050	none none 900	479 479 479	300 300 380	50 50 70	35 35 120
	PHILCO	A 1071-2 A 1072-2 A 1074-2	\$270 \$300 \$380	n.a. n.a. n.a.	2.3 2.3 2.3	3,640 3,640 3,640	1/10 1/6 1/6	1,160 1,130 1,130	none none 950	560 460 460	310 310 310	100 70 100	none none none
	RCA WHIRLPOOL	D-7100-3 Deluxe S-7100-3 Supreme L-7100-3	n.a. \$300 \$350	n.a. 9,700 n.a.	2.5 3.0 2.5	n.a. n.a. n.a.	1/8 1/8 1/8	1,110 1,050 1,110	none 950 920	n.a. 490 n.a.	310 310 310	none 95 95	none 140 140
	SEARS, ROEBUCK	77510 77310 77010	\$190 \$240 \$290	7,900 8,600 10,500	2.9 2.6 3.2	3,640 3,640 4,730	1/12 1/8 1/8	1,050 1,050 1,050	none 950 950	500 620 620	250 320 300	none 50 50	none 250 250
	VORNADO	D 100C-1 W 100C-1 W 100C-2	\$300 \$330 \$340	8,195 8,535 10,040	1.4 1.3 2.3	3,640 3,640 4,726	1/10 1/8 1/8	1,050 1,530 1,530	none none none	n.a. n.a. n.a.	400 375 375	none 55 55	70 75 75
	YORK	E 100 E 100L EM 100AP	\$350 \$370 \$420	9,500 9,000 9,000	3.0 2.3 2.8	4,320 3,732 4,320	1/8 1/8 1/6	1,090 1,090 1,025	none none 950	540 540 420	320 320 290	120 120 75	85 85 75

NOTES: n.a. This information not available.

a. one charcoal filter and one glass filter.

b. one metal filter and one glass filter.

	AIR FILTER		SENSITIVITY OF THERMOSTAT (deg.)	POWER SUPPLY				CABINET			
	TYPE	SIZE (sq. in.)		RATED VOLTS	RATED AMPS	RATED WATTS	EFFICIENCY (BTU per watt)	HEIGHT (in.)	WIDTH (in.)	DEPTH (in.)	OUTSIDE LOUVER MATERIAL
	glass metal	176 166	6 6	115 115	7.5 7.5	810 810	7.6 7.6	20 20	26 26	17 17	none none
	glass glass	258 298	5 4	115 115	7.5 11.9	840 1,180	7.5 6.3	16 23	27 27	31 19	none alum.
	glass a	171 171	5 5	115 115	7.5 10.5	850 1,100	n.a. n.a.	15 15	25 25	23 33	none none
	alum. alum. alum.	156 156 156	3 3 3	115 115 115	11.2 11.2 7.5	1,190 1,190 960	6.3 6.3 7.8	31 31 31	27 27 27	15 15 15	none none none
	glass glass	156 156	5 5	115 115	12.0 7.5	1,100 880	n.a. n.a.	16 16	27 27	16 19	steel steel
	glass glass	176 176	3 3	115 115	10.4 7.5	1,130 880	7.3 7.4	14 14	26 26	37 37	steel steel
	glass glass b	161 161 322	5 5 5	115 115 115	12.0 7.5 11.0	1,290 900 1,150	5.8 7.3 6.7	20 20 20	25 25 25	17 17 17	alum. alum. alum.
	glass	185	n.a.	115	7.5	800	8.4	16	24	24	none
	glass glass glass	140 273 345	3 3 3	115 115 115	11.5 11.8 11.8	1,150 1,180 1,150	6.2 7.0 7.8	14 15 16	22 26 26	24 26 29	none none none
	b alum.	184 324	2 2	115 115	7.5 7.5	860 880	7.7 7.5	16 21	26 26	24 17	steel steel
	glass	163	5	115	7.5	850	n.a.	16	26	30	none
	glass metal	156 156	5 5	115 115	7.5 7.5	860 860	n.a. n.a.	27 27	16 16	18 21	steel steel
	glass	183	n.a.	115	7.5	820	8.2	16	24	24	none
	glass metal metal	163 163 147	4 4 4	115 115 115	12.0 7.5 12.0	1,310 970 1,450	5.7 6.4 5.2	16 16 25	26 26 31	30 30 13	none none steel
	glass metal metal	176 176 176	6 6 6	115 115 230	12.0 12.0 7.5	1,300 1,300 1,500	6.8 6.8 6.7	20 20 20	26 26 26	17 17 17	none none none
	glass glass glass	258 258 298	5 5 4	115 230 230	11.6 7.0 7.9	1,355 1,300 1,340	5.9 7.0 6.7	16 16 23	27 27 27	34 31 19	none none alum.
	glass a a	171 171 171	5 5 5	115 115 230	11.5 12.0 7.5	1,225 1,350 1,600	n.a. n.a. n.a.	15 15 18	25 25 27	23 33 16	none none steel
	alum. alum. alum.	171 171 171	3 3 3	230 230 115	7.5 7.5 12.0	1,475 1,475 1,470	6.5 6.5 6.5	31 31 31	27 27 27	15 15 15	none none none
	glass glass glass	156 156 156	5 5 5	230 230 115	8.0 8.4 11.4	1,600 1,600 1,100	n.a. n.a. n.a.	16 16 16	27 27 27	16 19 19	steel steel steel
	glass glass glass	176 176 176	3 3 3	230 115 230	6.3 11.8 6.3	1,310 1,310 1,305	6.8 6.9 7.7	14 14 14	26 26 26	37 37 37	steel steel steel
	glass glass b	161 161 322	5 5 5	115 230 230	12.0 6.8 6.8	1,300 1,480 1,480	6.9 6.8 6.8	20 20 20	25 25 25	17 17 17	alum. alum. alum.
	glass glass	185 186	5 5	230 230	7.1 6.9	1,453 1,507	6.4 6.6	16 17	24 30	24 18	none steel
	glass glass	140 273	3 3	230 230	6.8 8.5	1,425 1,500	6.4 7.2	14 15	22 26	24 26	none none
	b b alum.	184 184 324	2 2 2	115 230 230	12.0 8.0 8.0	1,240 1,460 1,600	7.0 6.5 6.7	16 16 21	26 26 26	24 24 17	steel steel steel
	glass glass elect.	163 119 357	5 5 5	115 115 115	12.0 12.0 12.0	1,220 1,350 1,350	n.a. n.a. n.a.	16 16 16	26 26 26	20 20 24	none steel steel
	glass metal elect.	156 118 126	5 5 5	230 230 230	8.0 8.0 8.0	1,620 1,520 1,870	n.a. 6.4 n.a.	27 26 27	16 18 16	18 18 21	steel none steel
	glass glass elect.	177 177 175	none 4 4	115 115 230	12.0 12.0 7.3	1,260 1,300 1,425	6.3 6.6 7.4	23 25 25	26 26 26	15 16 16	none none none
	glass glass glass	183 200 200	n.a. 5 5	115 115 230	11.2 11.8 7.0	1,300 1,400 1,500	6.3 6.1 6.6	16 17 17	24 30 30	24 17 17	none steel steel
	glass alum. alum.	163 163 147	4 4 4	230 115 230	6.5 12.0 8.5	1,685 1,310 1,750	5.6 6.8 5.1	16 16 25	26 26 31	30 30 13	none none steel

dirty. The glass-fiber ones should be discarded when dirty and replaced. The bigger they are, the better.

Noise. Air conditioners, like refrigerators, don't make much, but you'll want to sleep with the thing running. Unfortunately, there's no objective way to measure quietness. Decibel ratings are little help, for the *kind* of noise matters more than loudness—a moderate hum may put you to sleep while even a faint whistle will keep you awake.

What noise there is comes mostly from the air flow. So low fan speed and air-moving capacity are clues to quietness—but only clues. If you're the type that wakes up when the relay clicks on your electric blanket, better get a unit with an adjustable fan speed.

Thermostat. Nearly all conditioners use expanding gas inside a bellows to control their operation. The sensitivity of these thermostats varies quite a bit. Some are supposed to switch on or off with a two-degree change in temperature, while others require a five-degree change. Such a difference would be noticeable to you.

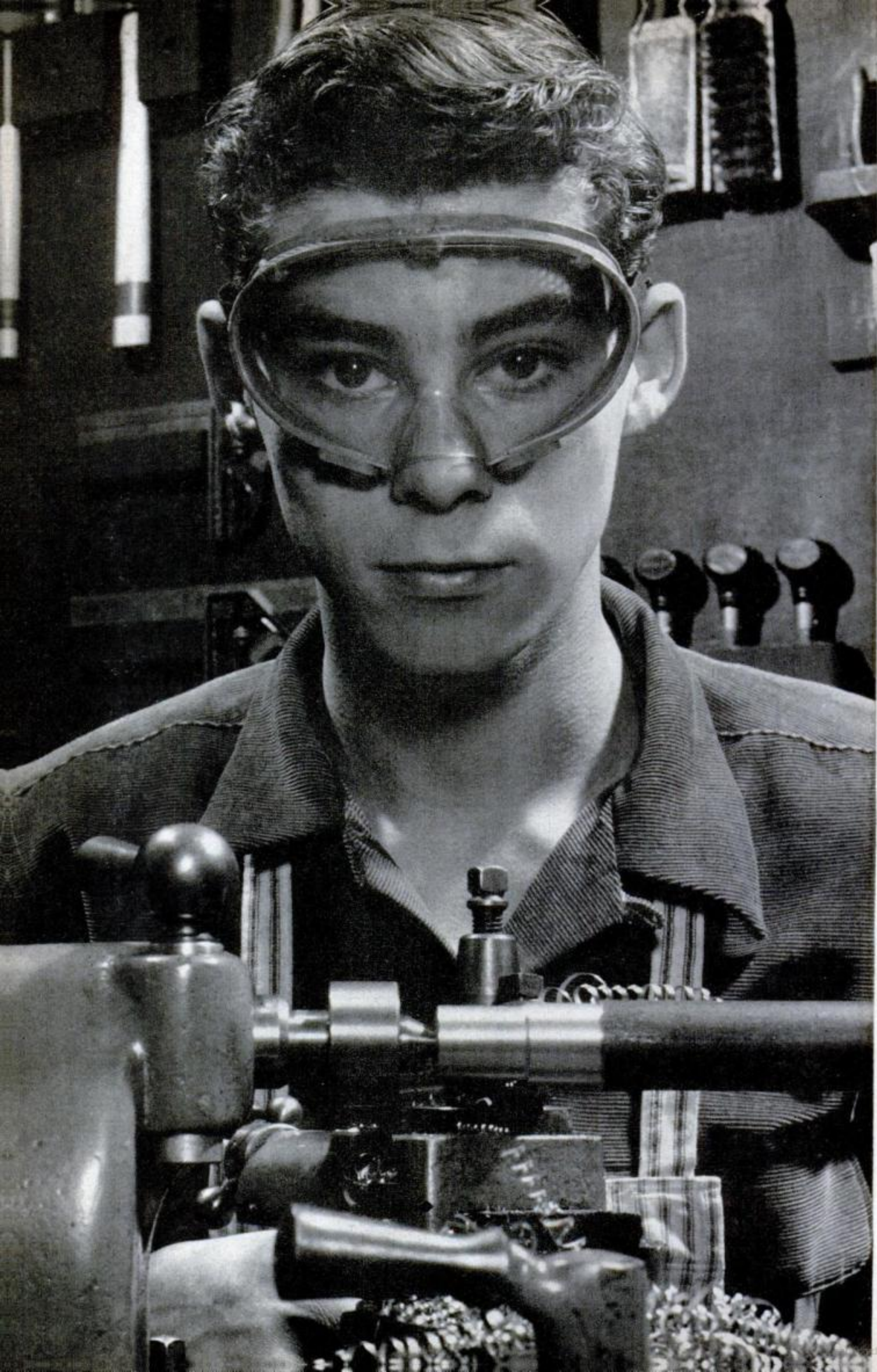
Power supply. There's confusing variety in the electrical appetites of air conditioners. You can get ¾-horsepower units that consume 7.5 amperes or 12 amperes (115 volts in either case). You can get one-horsepower jobs that prefer 115 volts or 230 volts. Here are the pros and cons:

- 7.5 amp—115 volt—¾ horsepower. This can be plugged into a house wiring circuit that you already have (in most cities), and it is very efficient (lower operating cost). But the first cost is high and the cooling capacity low.

- 12 amp—115 volt—¾ horsepower. This type has higher capacity and it's cheaper. But it is not so efficient, and it requires an electrical circuit all to itself. This means you'll have to get a new circuit installed for it.

- 12 amp—115 volt—one horsepower. Capacity runs higher than either ¾-horsepower type, but not so high as the 230-volt one-horsepower jobs. You'll need a

[Continued on page 238]



How to help your youngster toward

Success Without a College Degree

Opportunity doesn't knock—it hammers for people with training that no college offers. Here's how your child can acquire it.

By David Lindsay

THE Great American Dream includes a college education for the kids. The diploma is supposed to be a ticket to happiness and prosperity—the trim home on a tree-lined street, the shiny car, the “right” friends. Like most dreams, this one isn't true.

Two-thirds of the youngsters leaving high school this month will *not* go on to college. This lack of a college degree need not handicap them. They will actually find more opportunities for satisfying careers—a greater number of jobs, and a greater variety—than their college-educated friends. Their pay will be as good, in many cases better. The greatest increase in income in the past 10 years went, not to holders of college degrees, but to men and women in the skilled trades.

The explanation is simple. We need more and more skilled people for the complex jobs that modern civilization creates. There aren't enough such people now. Everybody knows about the scarcity of engineers and scientists. Not so well known is the more serious shortage of expert craftsmen and technicians. The U. S. Office of Education estimates that industry requires two to five technicians for every engineer. That's 10 times as many as we are turning out today.

These exciting and profitable oppor-

tunities—in electronics, aviation, building, nursing, business and many other fields—require the kind of training you can't get at, say, Stanford or Illinois Tech. It can be acquired at other kinds of schools—technical institutes, junior colleges, extension schools, trade schools, and many others.

Non-college education is now growing faster than any other type. Already there are 600 junior colleges, between 1,400 and 1,600 business schools, more than 400 private correspondence schools, 1,115 nursing schools. The number increases every day. The education they give is a true alternative to college, not a second choice.

College or not? You should decide about college training for your child as early as you can. There are two main points to consider:

- Can you afford it?
- Is your child suited to the academic schooling that is the standard college's specialty?

Don't answer either question too quickly. Money may not be the obstacle you think it is, as a later article in this series will show. The important point is: What is your youngster like? If he is a whiz at books, truly outstanding in English, history, math, then no chance for college training should be overlooked. But if he just gets by the academic courses while showing genuine ability in

other fields, he will probably be better off with some kind of specialized non-college schooling.

School reports tell only part of the story. Talk to teachers and guidance counselors, who often spot abilities that don't show up in schoolwork or even at home. Most important of all: By careful, long-term observation and questioning, find out what your youngster *wants* to do. It's far better for him to become a topnotch mechanic enjoying his job than a so-so history teacher working just to make a living.

If your decision calls for non-college training, you'll have *more* to do helping your youngster than if he were aiming for college. The range of possibilities is greater right straight through. You will have more choices to make about high-school courses; you must decide on a career much sooner; and selection of a school for after-high-school training will be complicated. Financing this kind of education may be more difficult: there are fewer scholarships. But fees are often moderate, and some schools are free.

Picking the career. This comes first because everything else depends on it. Is your son fitted, by taste and talent, to be an electronics technician? A carpenter? Is your daughter best suited to nursing? Drafting? There are three points in time where career choice is important:

- At the beginning of high school. You must help your youngster choose between the college-prep course and some other.

- In the 11th grade. Most vocational training in high school begins then.

- At high-school graduation. You must select a school for specialized training.

The answer to this career question may freeze the pattern of your youngster's life for 60 years to come. So get all the advice you can. Specifically:

- Take full advantage of high-school guidance and testing facilities. Expert guidance counselors know about rich careers you may never have heard of. And they can tell, with surprising accuracy, which ones your child is likely to fit.

- Encourage your youngster to talk to people already working in the fields he prefers. He may be disillusioned of romantic dreams—or awakened to the real value of a career he sneered at.

- Urge him to try out his choice with appropriate summer jobs.

In the end, you and he together must make the career decision. (We'll have more tips on this problem in an article next month.)

High school. With mighty few exceptions, your youngster will need his high-school diploma. It itself represents training. And the best of the intensive, specialized training outside of high school is available only to high-school graduates. So keep pressure on him to finish school. What he studies is particularly important. He'll get a head start toward a good skilled job from vocational courses.

Big-city schools teach aviation mechanics, machine-shop work, printing and so on. Many county vocational courses can give a high-school student as much as he'd get in a private trade school. For girls, the excellent secretarial training provided by many high schools may be all they need for good jobs right after high school.

Steer your youngster toward basic courses that will establish a foundation of knowledge for his chosen field: metal-working and drafting for technical careers, typing and bookkeeping for business careers. But don't specialize too much too soon.

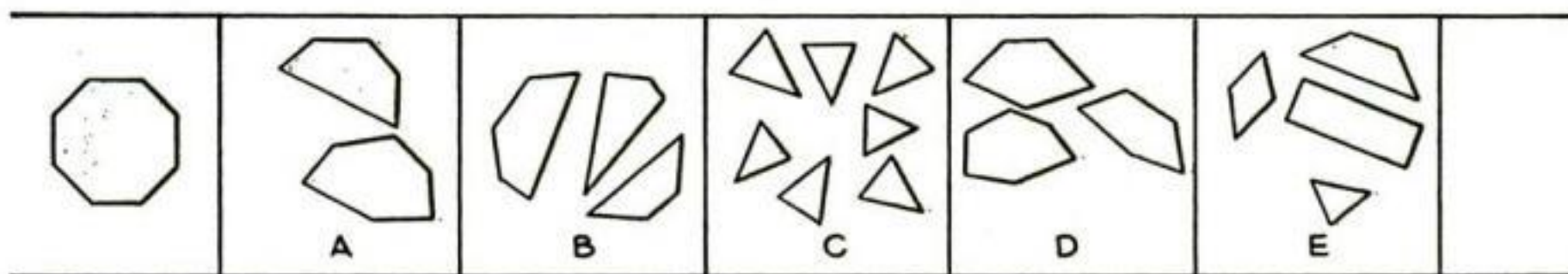
Don't neglect the books. Book learning seems dull to a boy planning to work with his hands, but it is important today in any occupation. A master carpenter has to read blueprints, figure stresses, estimate costs accurately. A top machinist lives with geometry and trigonometry.

You can help here. Show your boy how you use mathematics, reading and writing in your job. Remind him that fast promotion goes to the man with rounded skills—the one who uses his head as well as his hands, who catches on fast to trade-journal articles, who writes a clear report to the boss. These

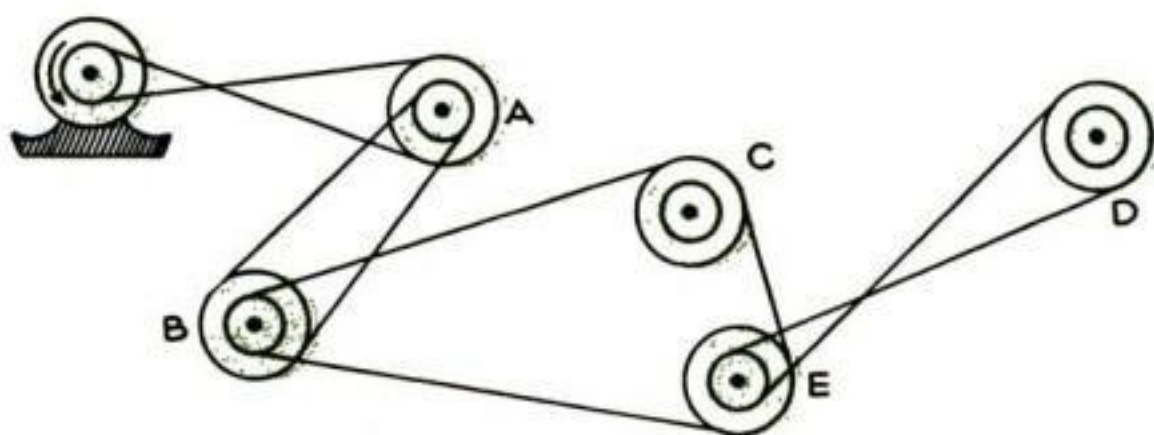
How they spot mechanical talent

WHAT does it take to make a good machinist, TV repairman, auto mechanic? Tests by psychologists reveal much about a youngster's interest and aptitude for such work. What these

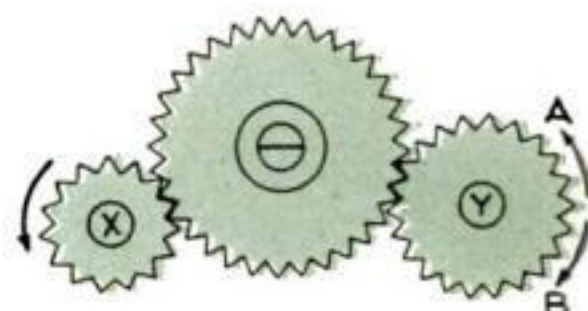
tests are like is shown by the samples below, prepared by the California Test Bureau. They are typical of examination questions used to select students for technical training. Correct answers are shown upside-down at the bottom of the page.



1. Write the letter of the group of pieces which, when put together, will make up the figure at the left.

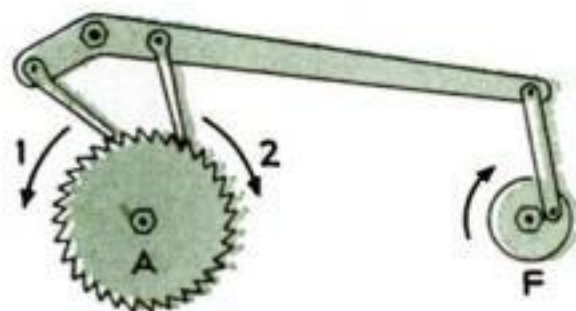


2. Which lettered wheel is turning in this direction?



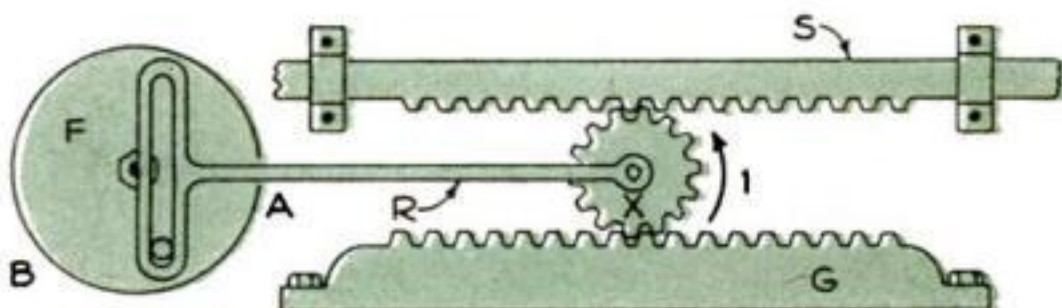
3. If gear X turns in the direction shown, in what direction will gear Y turn?

A B



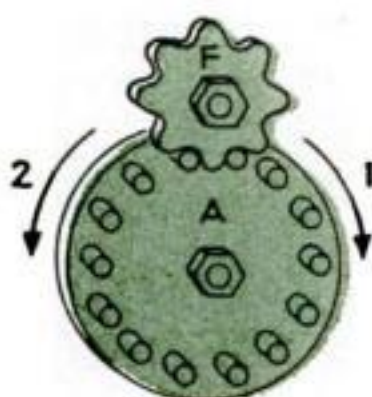
4. When wheel F turns in the direction shown, wheel A

1. must turn in direction 1.
2. must turn in direction 2.
3. may turn in either direction.



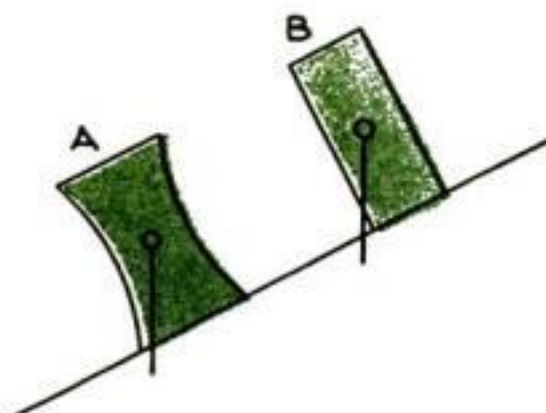
5. Rack G cannot move. Rack S can move back and forth. As the bolt on wheel F moves from position A to position B

1. arm R moves to the right.
2. wheel X turns in direction 1.
3. rack S and arm R move in opposite directions.



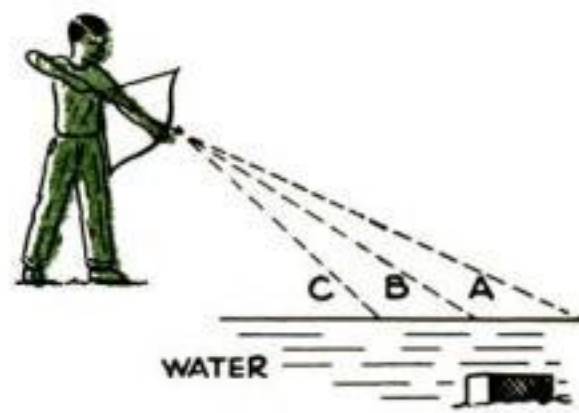
6. In order for wheel F to be turned, wheel A

1. must turn in direction 1.
2. must turn in direction 2.
3. may turn in either direction.



7. Which of the two objects, with the center of gravity as shown, would fall over? If neither would fall, mark C.

A B C



8. To the boy, the object in the water appears to be in the position shown. Along which line should the arrow be aimed in order to hit the object?

A B C

ANSWERS: (C) 1. (B) 2. (C) 3. (A) 4. (B) 5. (A) 6. (A) 7. (B) 8. (A)
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are all things best learned in high school.

After high school. Most youngsters not bound for college want to go right to work. That salary check is almost irresistible. But unless the money is absolutely essential, you'll be wise to discourage it. Here's why:

- Vocational courses aren't enough. For the best jobs, he'll need intensive, specialized schooling after high school.

- He will learn faster and better by attending school full-time.

- If he must work to help pay for his training, insist that he start part-time studies immediately. The longer he waits, the tougher education becomes.

Where to learn a trade. No matter what your youngster plans to do, he can find a school that will train him to do it better. A New York vo-

cational high school prepares youngsters for acting, dancing and singing; the Los Angeles school system, naturally, plans to teach motion-picture techniques. In every industrial center public and private institutions train machinists, automobile repairmen, electronics technicians, draftsmen. Business schools are all over the country. There are schools for butchers, bakers, even candlestick-makers (that is, chemical technologists).

You don't have to live near a school to study a trade. Correspondence schools teach by mail everything from dress-making to diesel maintenance.

The number of schools and their variety are astonishing. That's fine. But it complicates your selection of the right one for your youngster. Here is a brief description of what they are like. Even this list is far from complete.

Public institutes. These prepare

young men for the most widely available skilled jobs, such as drafting, building trades, machine-shop work, auto and diesel maintenance, TV and radio repair. Typical ones: Division of Technology, Utah State Agriculture College (Logan, Utah), Nebraska State Trade School (Milford, Neb.). Tuition range: Nothing at all to \$300 or \$400, but usually

low. Admission requirements: High-school diploma and, for some schools, fairly good grades. Time in training: One or two years.

Private trade schools. Subjects range all the way from machine design to interior decorating. Quality of instruction varies—but state education departments usually list schools meeting minimum standards. Typical ones: Northwest

[Continued on page 206]

Where to Write for Lists of Schools

YOU'LL want to know more about schools that seem suited to your child's ambitions. The first place to check is the department of education of your own state. For detailed information on particular types of schools, try:

Technical institutes: National Council of Technical Schools, 1507 M St. N.W., Washington 6, D. C.

University extension schools: National University Extension Association, 152 Nicholson Hall, University of Minnesota, Minneapolis 14, Minn.

Correspondence schools: National Home Study Council, 1420 New York Ave. N.W., Washington 5, D. C.; and individual correspondence schools such as those whose advertisements ap-

pear regularly in the pages of Popular Science.

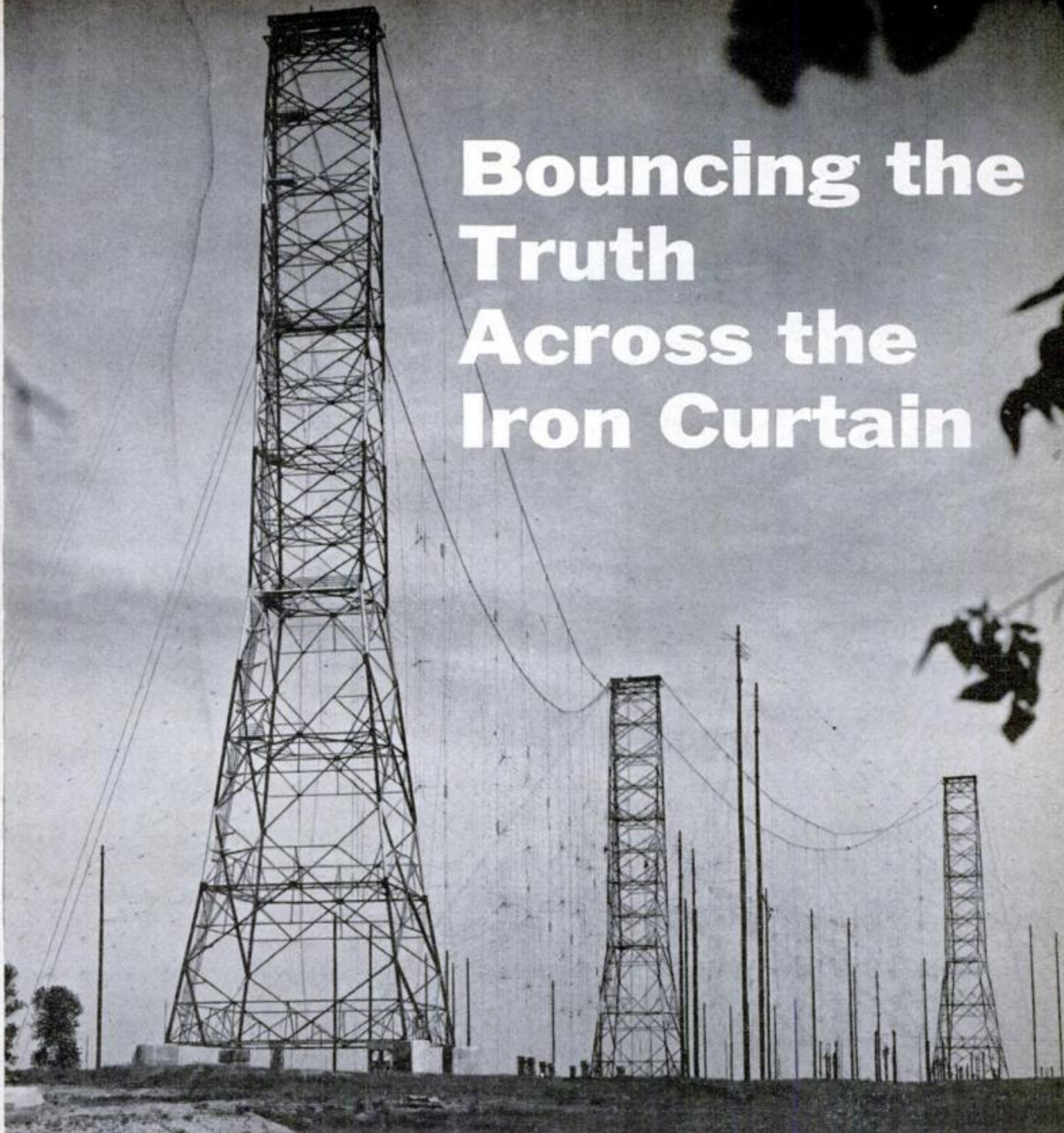
Armed services schools: Career Opportunities, Military Personnel Procurement Division, The Adjutant General, Washington 25, D. C.

Adult-education courses: National Association of Public School Adult Educators, 1201 16th St. N.W., Washington 6, D. C.

Junior colleges: American Association of Junior Colleges, 1785 Massachusetts Ave. N.W., Washington 6, D. C.

Nursing and medical-technician schools: National League for Nursing, 2 Park Ave., New York 16, N. Y.

Secretarial, business-administration and accounting schools: National Association and Council of Business Schools, 601 13th St. N.W., Washington 5, D. C.



Bouncing the Truth Across the Iron Curtain

Towering antenna setup near Cincinnati is part of Voice of America's world-wide network.

In the contest between free-world radio and Soviet jammers, Nature has dealt us one trump the Russians cannot top.

By Ernst Behrendt

THE pace is quickening in the electronic war between East and West. Western radio technicians are wracking their brains to devise new ways to get the truth past the Iron Curtain

into the Soviet Union and its satellites. The Russians are relentlessly stepping up their efforts to drown us out.

Since the uprisings in Poland and Hungary last fall, the Communist bloc has moved to jam the Voice of America and Radio Free Europe on an unprecedented

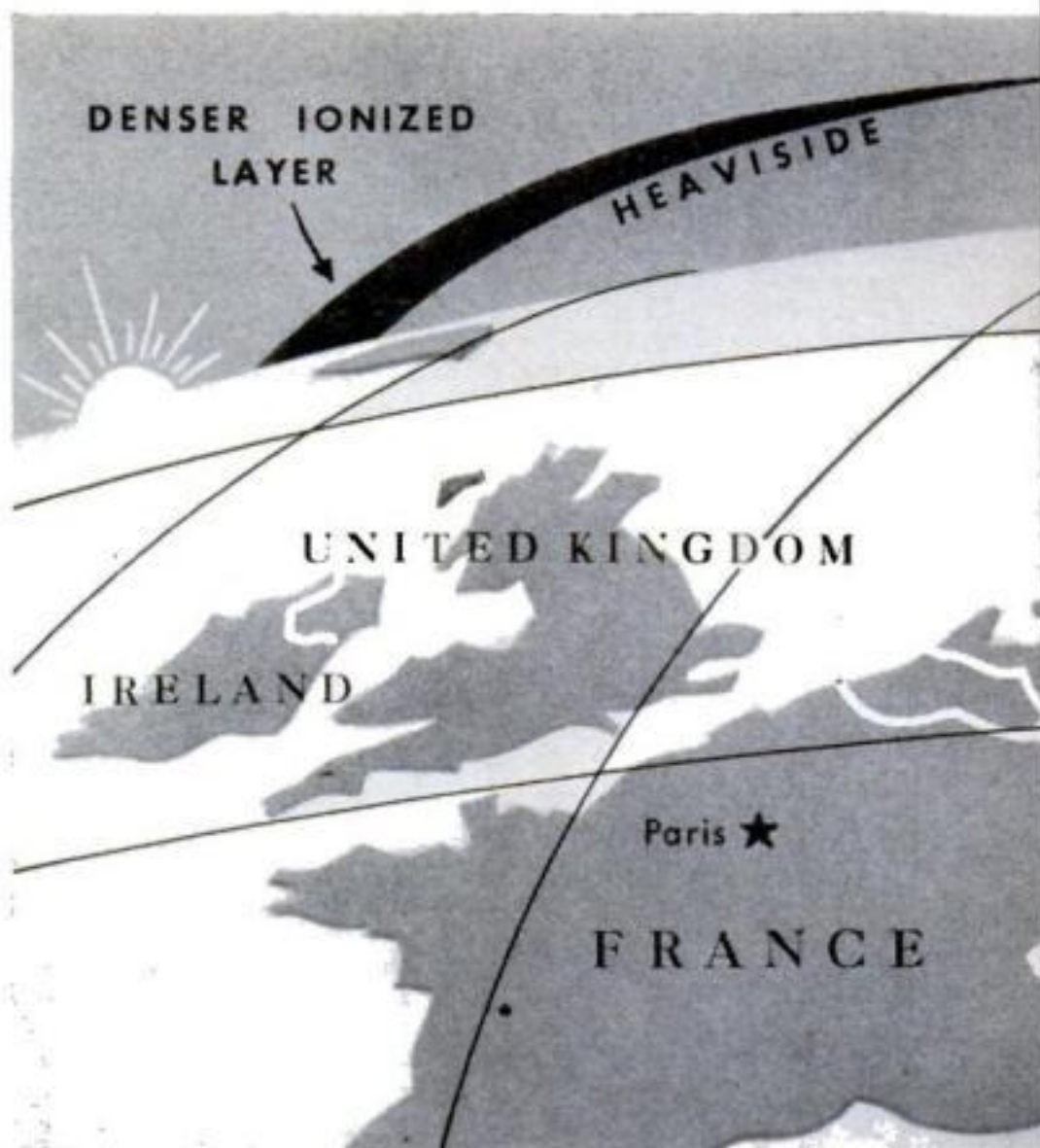


MUNICH MONITOR sweeps Radio Free Europe's short-wave bands hourly. Research indicates 95-100 percent of RFE programs reach their targets.

scale. When President Eisenhower made a world-wide broadcast recently, on VoA's fifteenth anniversary, his message was carried by its 78-station network—and later rebroadcast in 43 languages. Arrayed against him—according to latest estimates of monitors in Munich—were more than 1,000 Communist jamming stations. And now the Soviet is extending its radio interference to the Middle East, setting up jammers along the frontier of Iran and in the Caucasus, in an attempt to isolate the troubled nations of this area from Western broadcasts.

But it is costing them more than it does us. And in this war of the air waves, Nature is on our side.

It all started back in 1948, when the Russians began to block the U. S. Government-sponsored Voice of America which was hitting the whole Soviet Union broadside. In 1950, the Soviet also took countermeasures against the newly founded Radio Free Europe, an organization supported by contributions from private U. S. citizens to the Crusade for Freedom. RFE concentrated on Russian



HOW NATURE HELPS get the message through: When it's daytime in Western Europe, night has fallen over the Soviet Union. RFE transmitters

satellites—Poland, Hungary, Czechoslovakia, Romania and Bulgaria.

At first, the Soviet had only 25 stations. When they found that these were not enough to plug the radio holes in the Iron Curtain, they increased it to 50, then 100, then 250—and so on until their jamming network reached today's vast size.

What is jamming and how does it sound? Basically, it is simply transmitting a signal—a noise—on the same frequency as the broadcast itself. This noise can be created by a variety of electronic and mechanical devices. In World War II, the Germans jammed Allied radio communications with such diversions as the skirling of bagpipes, or the ear-rending whine of a buzz saw at high r.p.m. The Russians have done better: They are filling the ether with the stunning din of a locomotive as it might sound passing through your living room. Another much-used technique is dubbed "wobulation"—from wobble and frequency modulation. By shifting the jamming transmitter's frequency back and forth across that of the broadcast signal, they achieve



in Germany (in sketch above) and Portugal bounce short waves off the dense daytime Heaviside layer into the satellite countries, while

most of the jamming impulses from Communist stations pass through the much thinner nighttime layer and fade away into outer space.

a sirenlike whistle calculated to blot out the human voice. Actually, a tape recording of any ugly or hard-to-ignore sound serves the purpose very well.

But despite the Communists' best efforts, we hold one trump card they cannot top. Nature is fighting on our side with the Heaviside layer. This is a layer of particles far above the earth. During the day, the sun ionizes the particles so that they bounce short waves back to earth as a mirror bounces back a beam of light. At night, ionization diminishes, and signals pass through the layer.

Taking advantage of this phenomenon, Western engineers have erected powerful short-wave stations many hundreds of miles from the Soviet borders. These ricochet signals off the Heaviside layer into the USSR and its satellites. For three hours after night has fallen in the Soviet, it's still day in Western Europe. Hence, Red jamming signals pass ineffectively through the Heaviside layer. The best the Russians can do against "sky-wave" transmission is to use "ground-wave" jammers, which have a severely limited

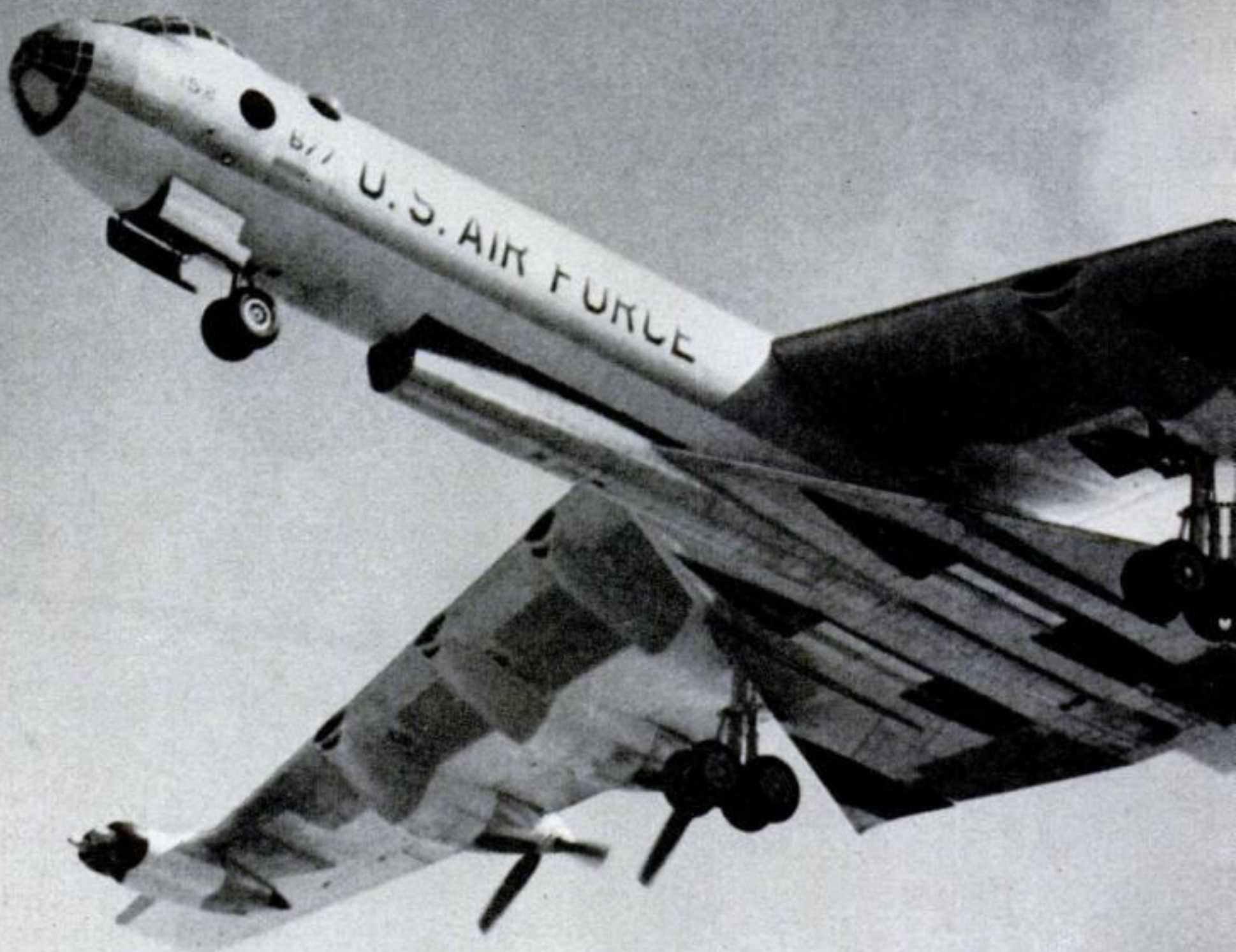
range. The effect is like that of trying to put out a large-area fire with a short-range hose.

Over the years, this electronic warfare has developed to a fine art, with Western technicians taking the lead in the battle of wits. Back in 1948, the U. S. Government-sponsored Voice of America devised Operation Cuddles, beaming broadcasts on wave lengths right next to Radio Moscow programs. To jam a signal and leave its next-door neighbor unharmed is a tricky business—usually you end up jamming both. At first, the Russians left the VoA alone. Finally, they decided that life without Radio Moscow was better than life with Cuddles, and they jammed both. That ended Cuddles.

Then VoA and Radio Free Europe switched to the Brute Force method, a massive broadcasting onslaught. During the Poznan riots, for example, RFE concentrated 22 powerful transmitters on Poland alone for some periods.

Another means used by RFE to get its voice across is to narrow the normally

[\[Continued on page 216\]](#)

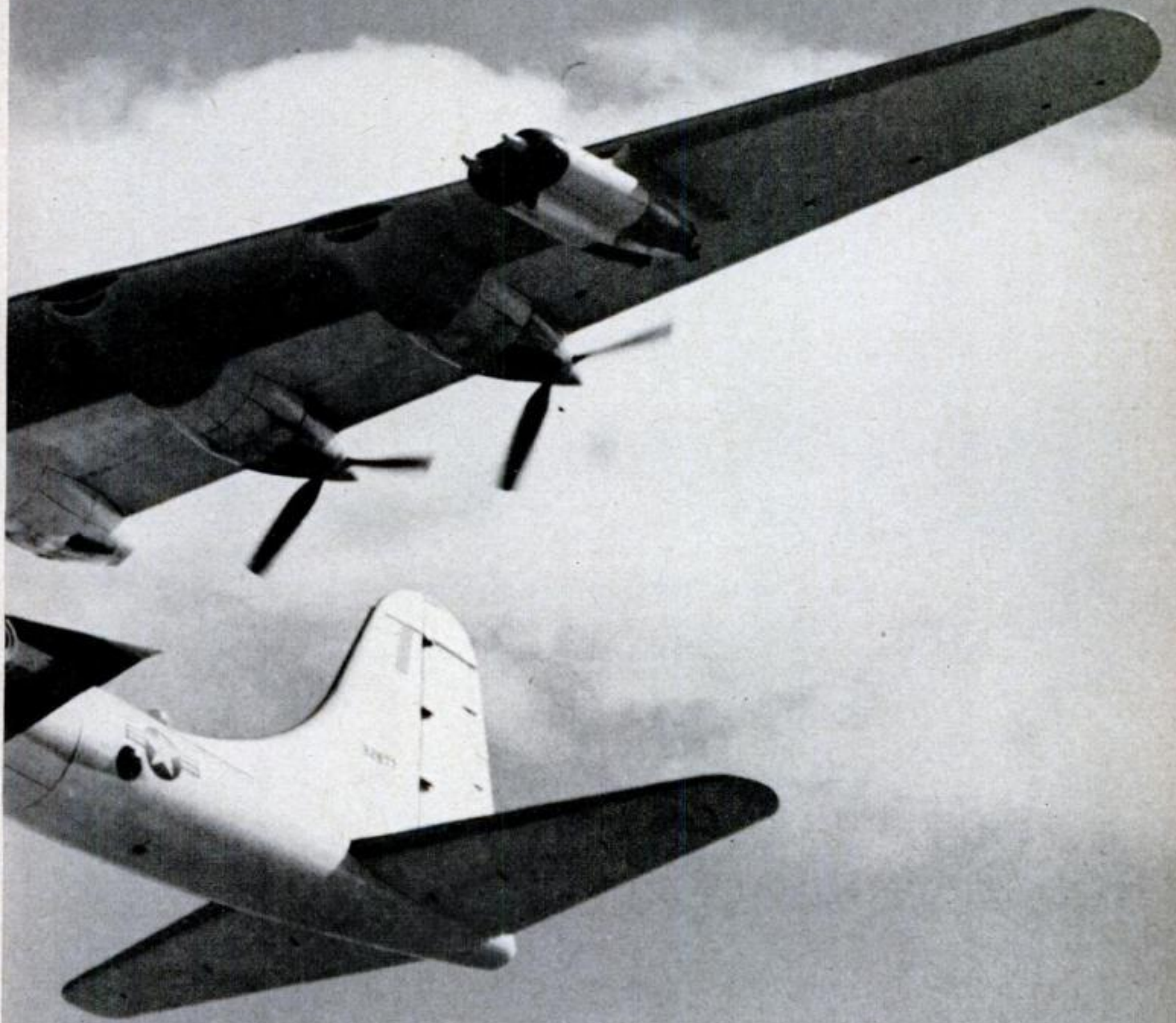


Fastest bomber gets a ride from the world's biggest

THE supersonic B-58 Hustler takes the air here under the belly of a B-36 in a remarkable air-transport operation. Minus its four jet engines and other equipment, the delta-winged Hustler was partly tucked into the B-36's bomb bay and flown nonstop from Fort Worth, Tex.,

Picture News

IN THE WORLD OF SCIENCE



to Wright-Patterson Air Force Base at Dayton, Ohio, for extensive tests of air-frame strength under extreme temperatures. To make room for the load, inboard propellers were removed from the B-36, and it flew, unable to retract landing gear, on four piston and four jet engines. Both Convairs, the Hustler has a 55-foot wingspan, the B-36, 230 foot.



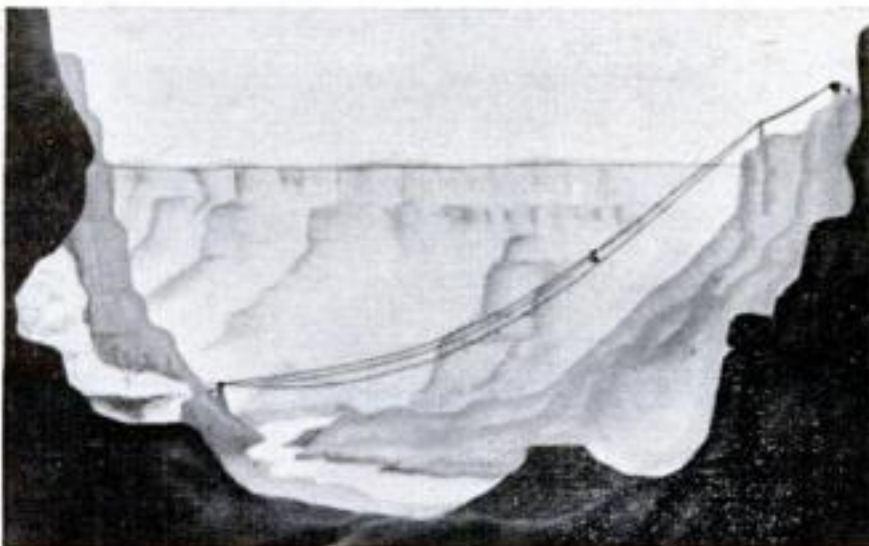
Air-conditioned walk beats heat at shopping center

WINDOW shopping is a breeze at this San Antonio center even with the Texas temperature at 100. Air conditioners, installed in three of the adobe-brick supports, cool this enclosed walk at North Towne Plaza.



Curbside phone lets motorist make calls from car

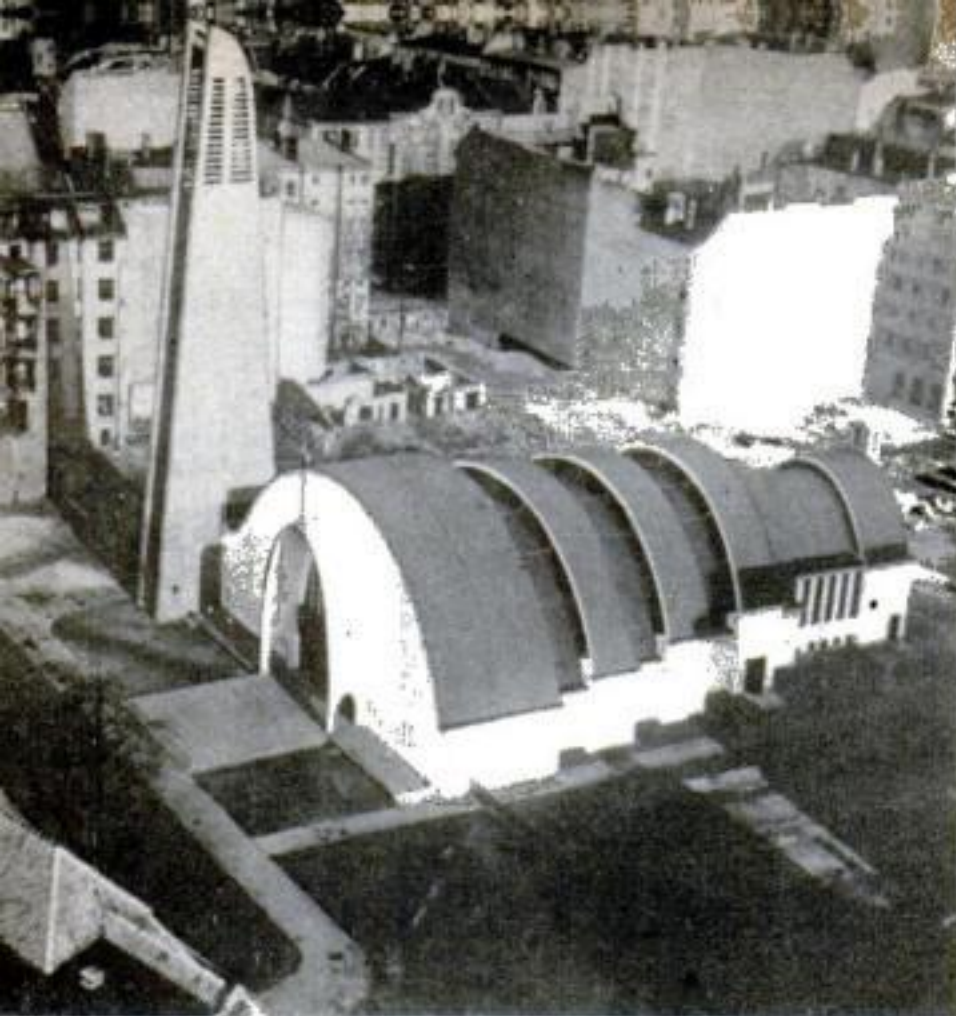
CURB service for automobile drivers is being tried out by the Chicago telephone company. Here the first call is being put through on one of three new weatherproof test phones installed at street curbsings.



Copter lays aerial-tram cable

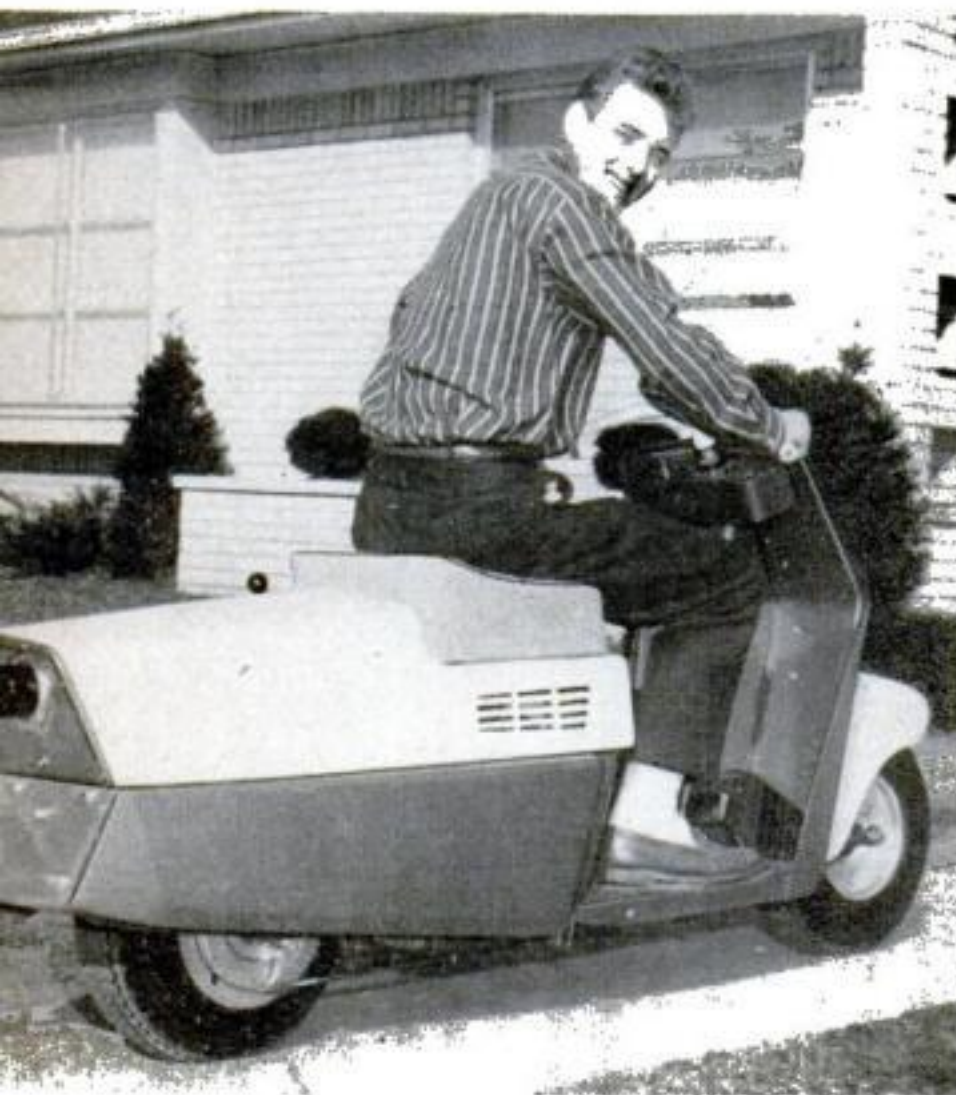
HOPPING from the rim of Grand Canyon, a helicopter starts laying the first cable of an 11,500-foot aerial tramway to Bat Cave, 600 feet up from the foot of the opposite wall.

This U. S. Steel project will permit mining deposits of guano fertilizer left by prehistoric bats. Vacuumed out of the cave, the powder will go by bucket tram to a packing plant on the canyon rim.



Rebuilt Berlin goes modern

THE imaginative lines of this church in the British sector of West Berlin are a departure from the bombed-out Gothic structure it replaces. Rebuilding is giving architects a field for new ideas.



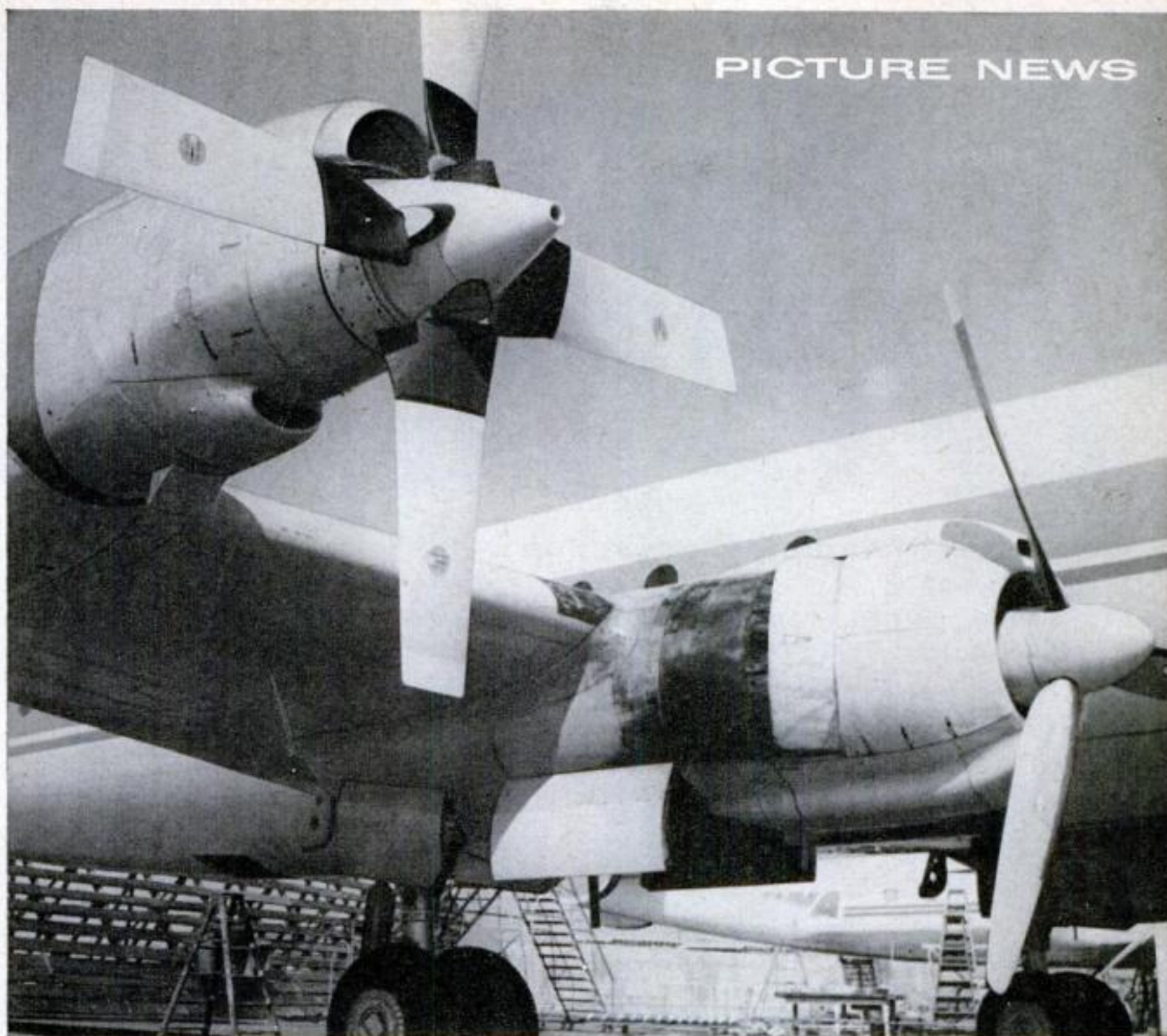
Scooter gets fancy tail fin

MODERN automotive styling has hit the scooter makers. This 1957 Cushman Road King, in a range of two-color combinations, has a streamlined rear deck terminating in a sporty tail fin. Extensive re-engineering includes a new motor.



He fires from Flying Platform

THE ease of controlling the Army's Flying Platform shows in this stability test. Its GI pilot has both hands free to fire his rifle. Hiller Helicopters, developer of the ducted-fan craft, is now designing a version with three 44-hp. engines.



PICTURE NEWS

Prop-jet under test uses four squared-off blades

THE stub four-blade propeller mounted outboard on the test plane above will power Lockheed's Electra, a short-to-medium range airliner. Geared to an Allison jet, it takes a $13\frac{1}{2}$ -foot bite compared to 15 feet for the conventional prop at right. Slow blade-tip speed cuts cabin noise.

Double-decker boxcar freights eight automobiles

DOUBLING the capacity of its older automobile-delivery freight cars, the Canadian National Railways has put into service 25 of these 78-foot double-deckers. The new all-steel boxcar, 34 feet longer than the ordinary car, carries eight autos—four each on upper and lower decks.

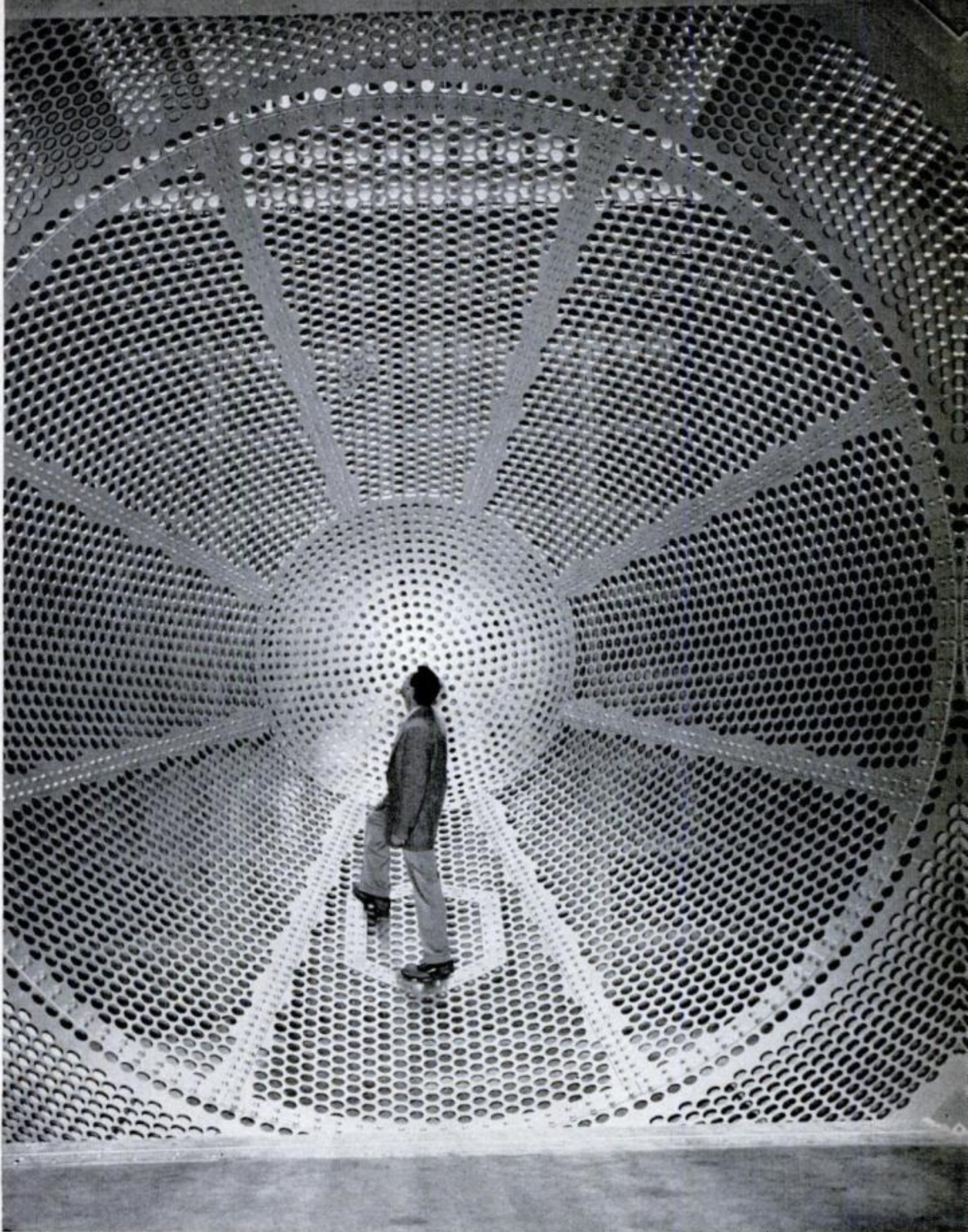




Bedecked with cameras, paratrooper films as he falls

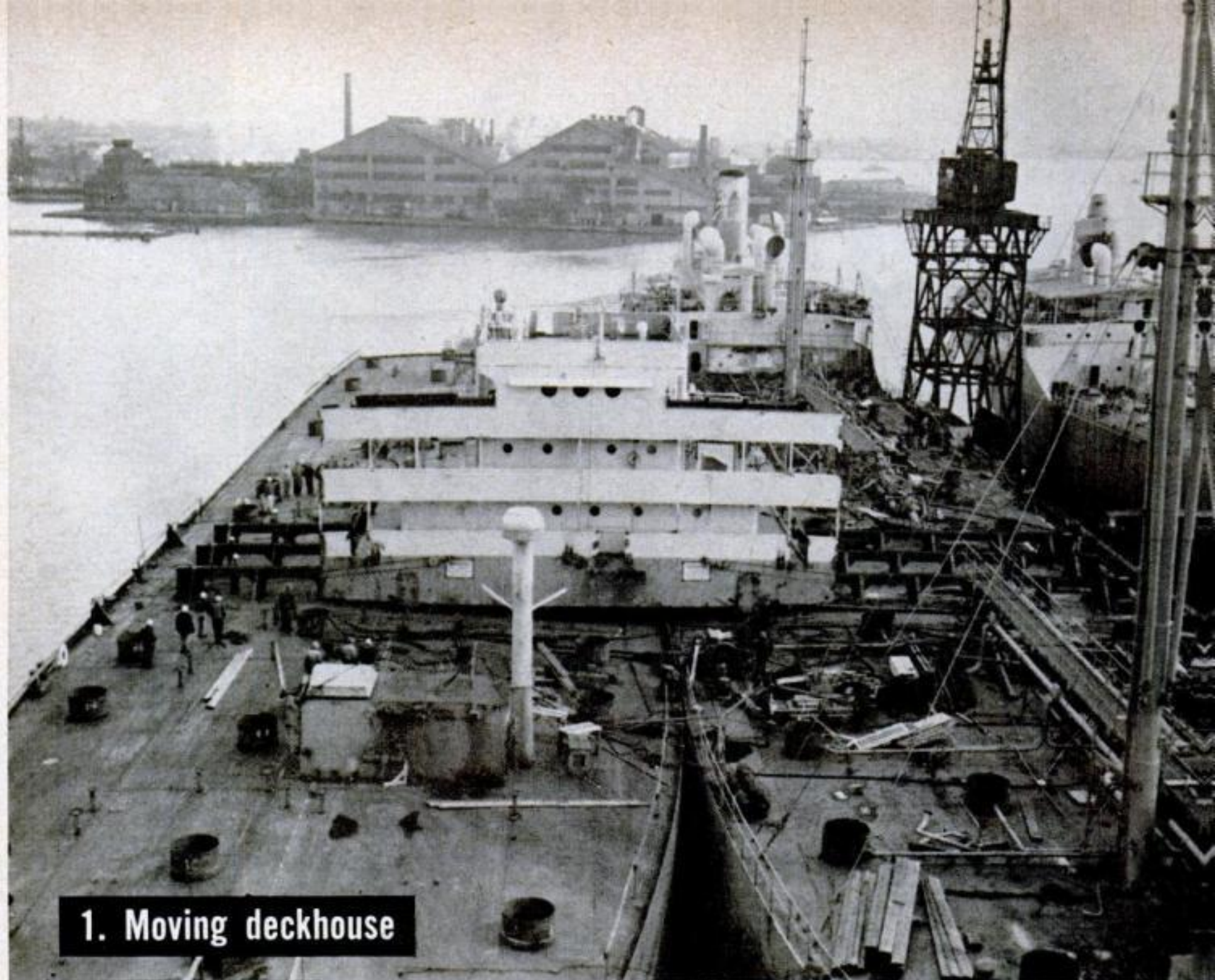
ACTION close-ups above—a pal diving off, and in free fall—were caught by Andre Suire, a French paratrooper, before pulling his ripcord. Shown below with his head harness mounting two movie cameras, Suire shoots each from the ear while hurtling through space at up to 125 m. p. h. Object is to click visual record of just what's going on during a jump.



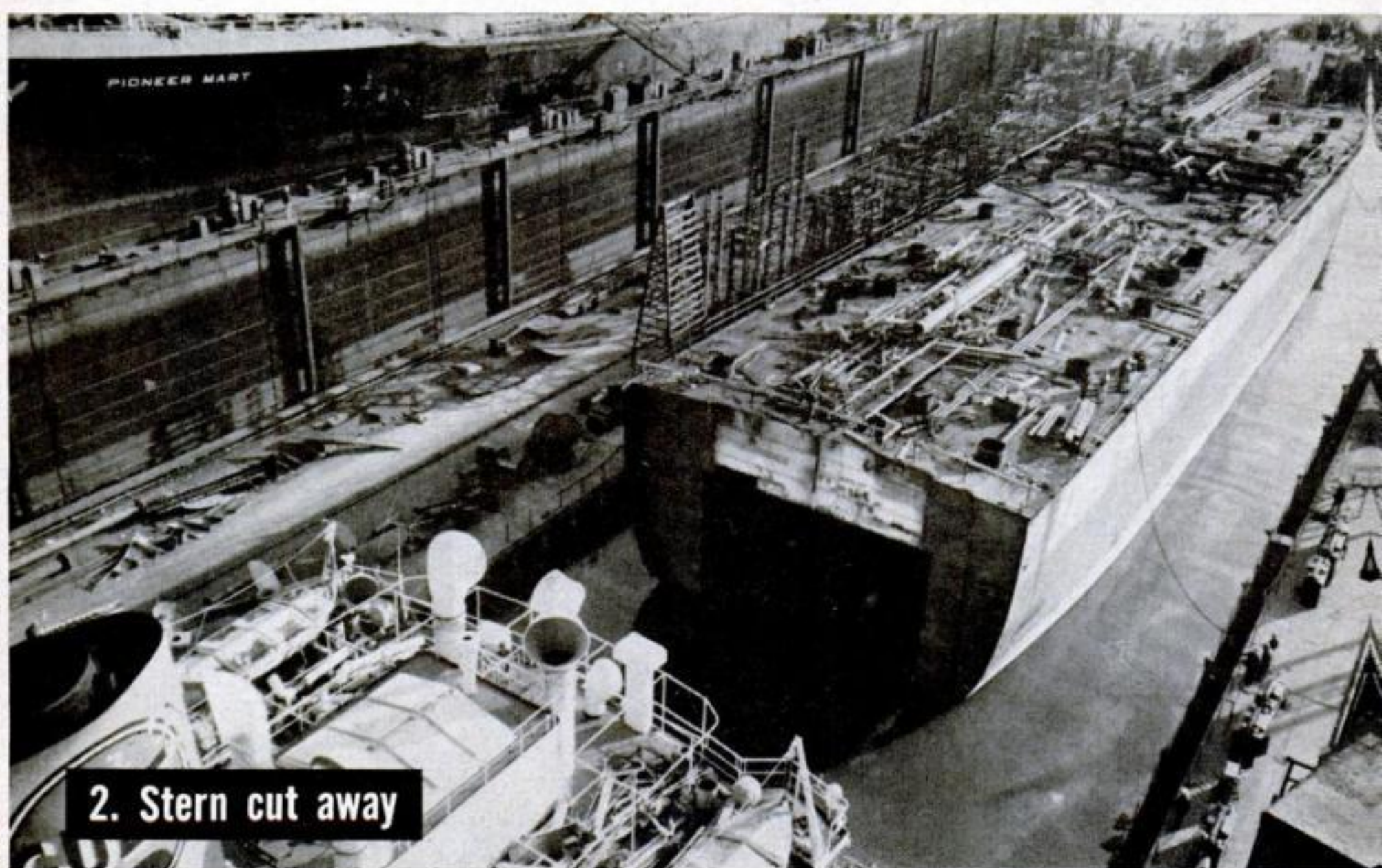


Big sieve tones wind tunnel's whoosh to gentle whish

THIS giant diffuser helps subdue winds blown at and above speed of sound from North American Aviation's new Los Angeles test tunnel. The screen, at entrance to the muffler building, protects its equipment from uneven shock. It is part of a \$100,000 soundproofing installation.



1. Moving deckhouse



2. Stern cut away



3. New midsection

New midsection "stretches" tanker, increases payload

U.S. SHIPYARDS are doubling the life of war-built T-2 tankers and enabling them to carry more oil. How it's done is shown in these photos of the Gulf Oil tanker Gulfmeadows being "jumboized."

A new and larger midsection is built while the ship is still in service. In dock, the old 160-ton midships house is moved to the ship's new cargo section (at left in photo 1).

Separated from the stern (foreground, photo 2), the bow and old middle are floated out, and the new midsection floated in (photo 3) and welded on. The bow is finally cut off, welded in place, and the old, worn-out cargo section scrapped.

Gulf is "jumboizing" nine ships in all, Amoco four, Socony-Mobil two, and other companies four in an initial program.

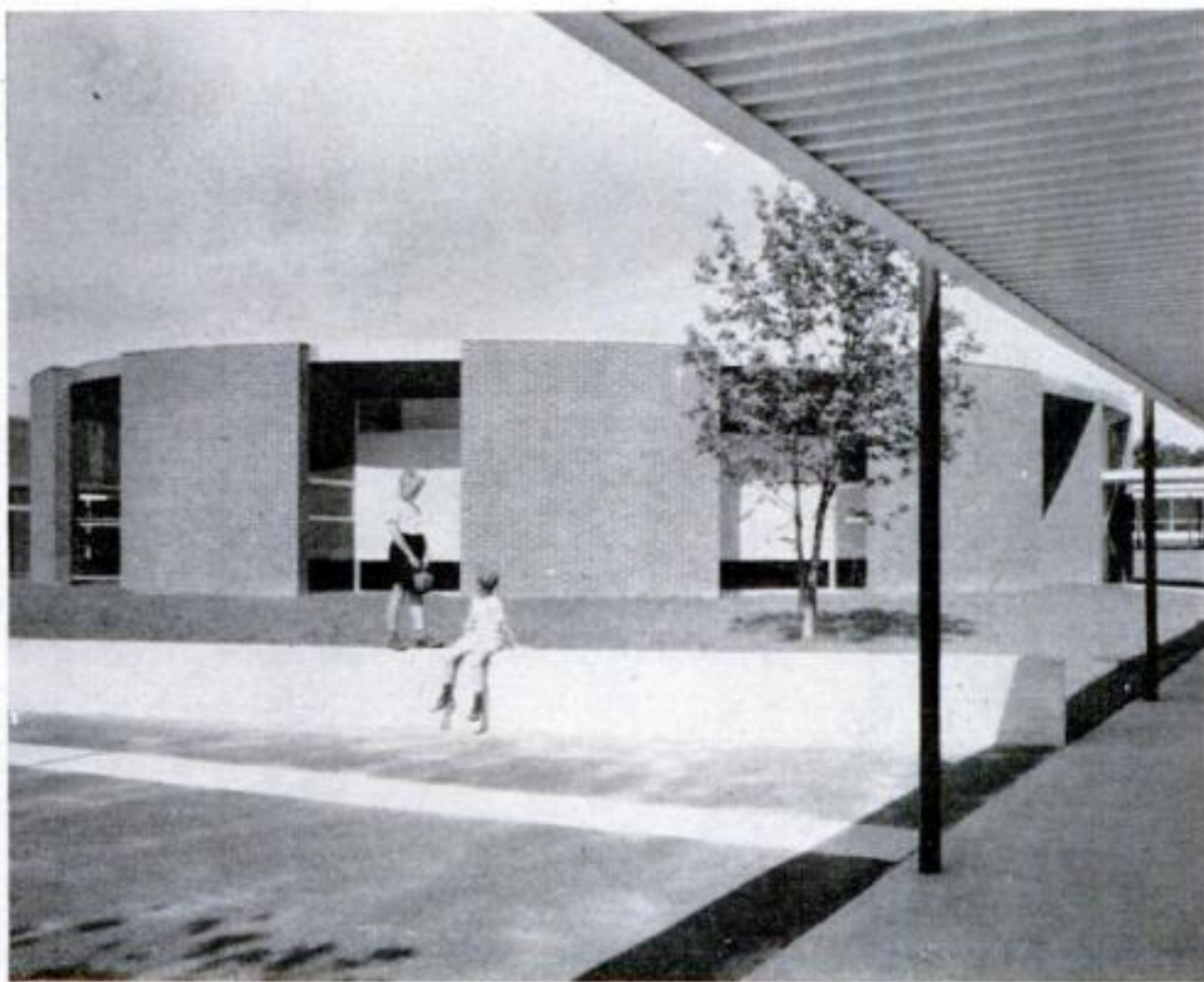
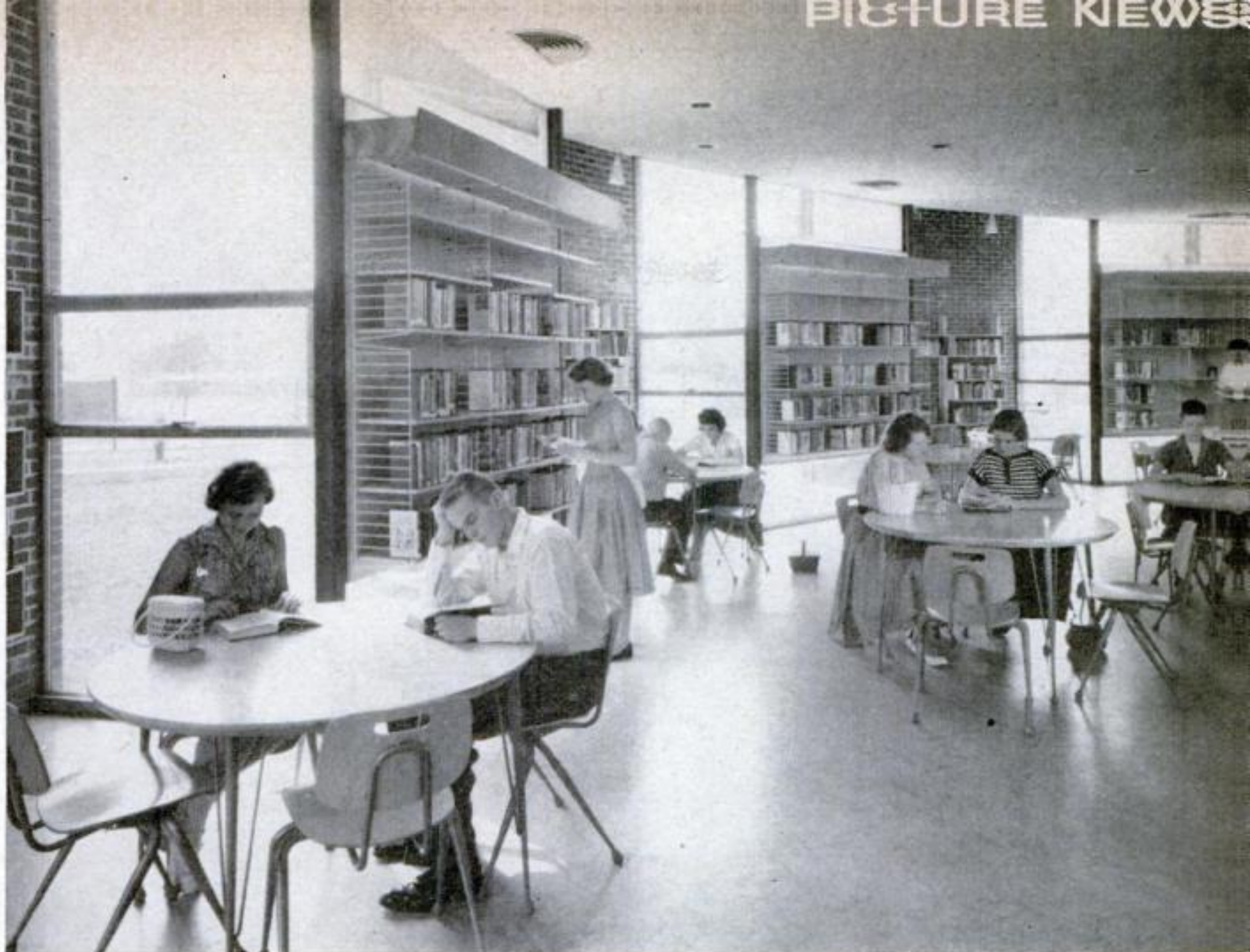


4. "Jumboized"



Helicopter takes on new job: tows 3,000-ton ship

WHIRRING away with versatility and power, this H-21 helicopter pulled a lumbering 3,000-ton LST at five knots during practice runs at the Navy's amphibious base at San Diego, Calif. The flying tugboat hauled the 382-foot tank-landing ship at about half the vessel's normal speed—and the LST was more maneuverable than when under its own power.



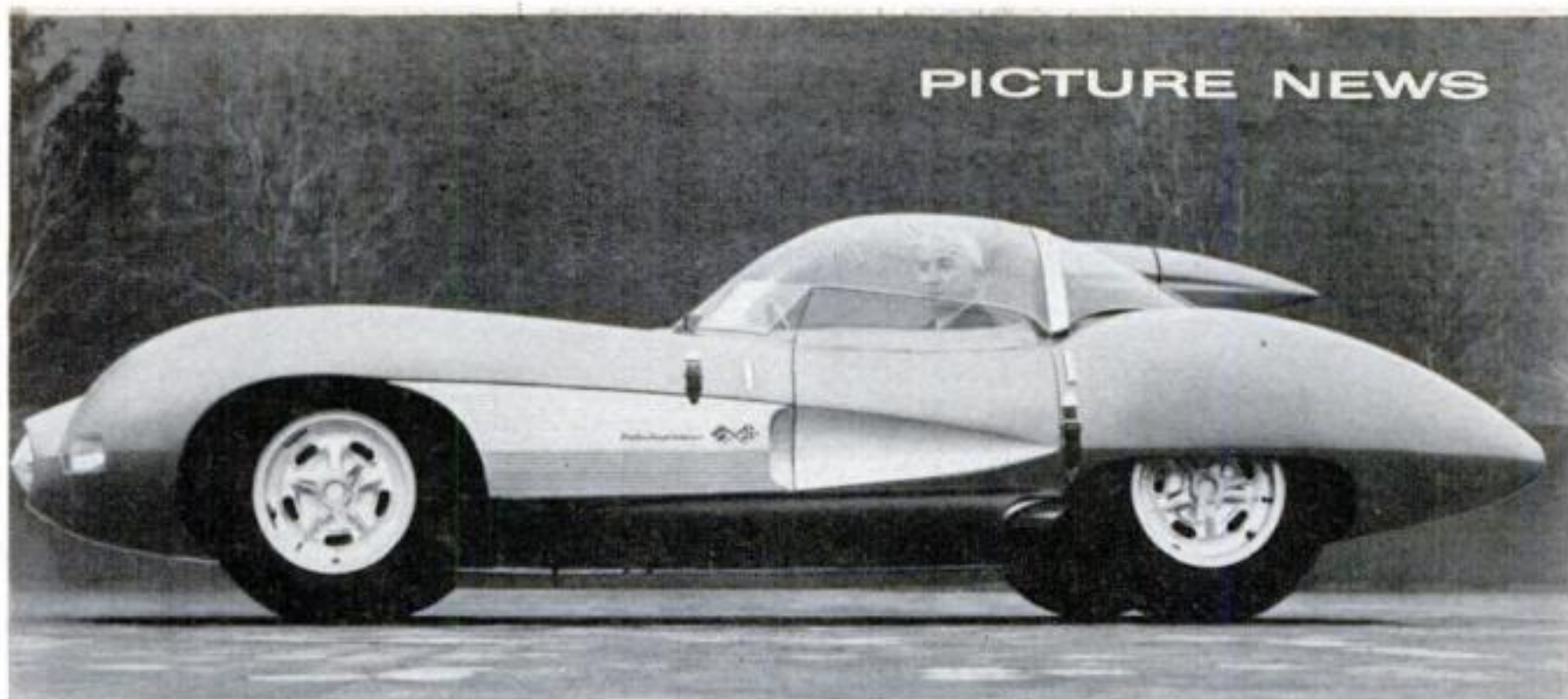
School's "cogwheel" library pours light into alcoves

GLASSED-IN on both sides, each "tooth" projecting from this circular library at the new Middleville Road High School, East Northport, L.I., forms a well-lit but semi-private study alcove. Exterior view of an alcove is shown at lower right. The library is at the hub of the campus-type buildings designed by Ketchum, Giná & Sharp, New York architects.



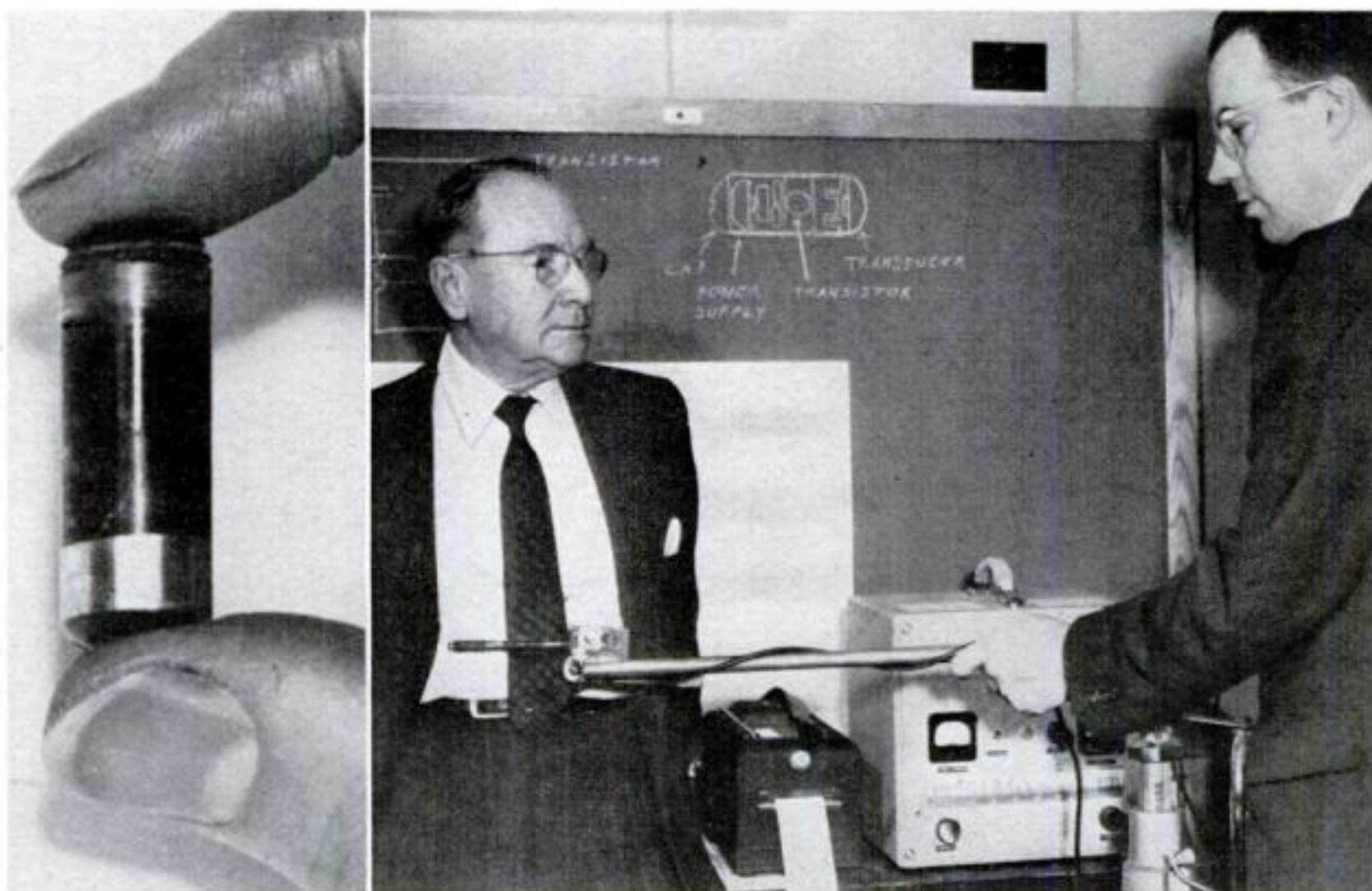
Two-ton bulldozer gets a lift on its way to work

HOISTED by pulleys, this bulldozer is leveled off for a landing on the 10th floor of the old Marguery, swank Park Avenue hotel being demolished for a 52-story New York office building. It took three minutes to go up, landed in 15, and will work its way down, pushing debris into chutes.



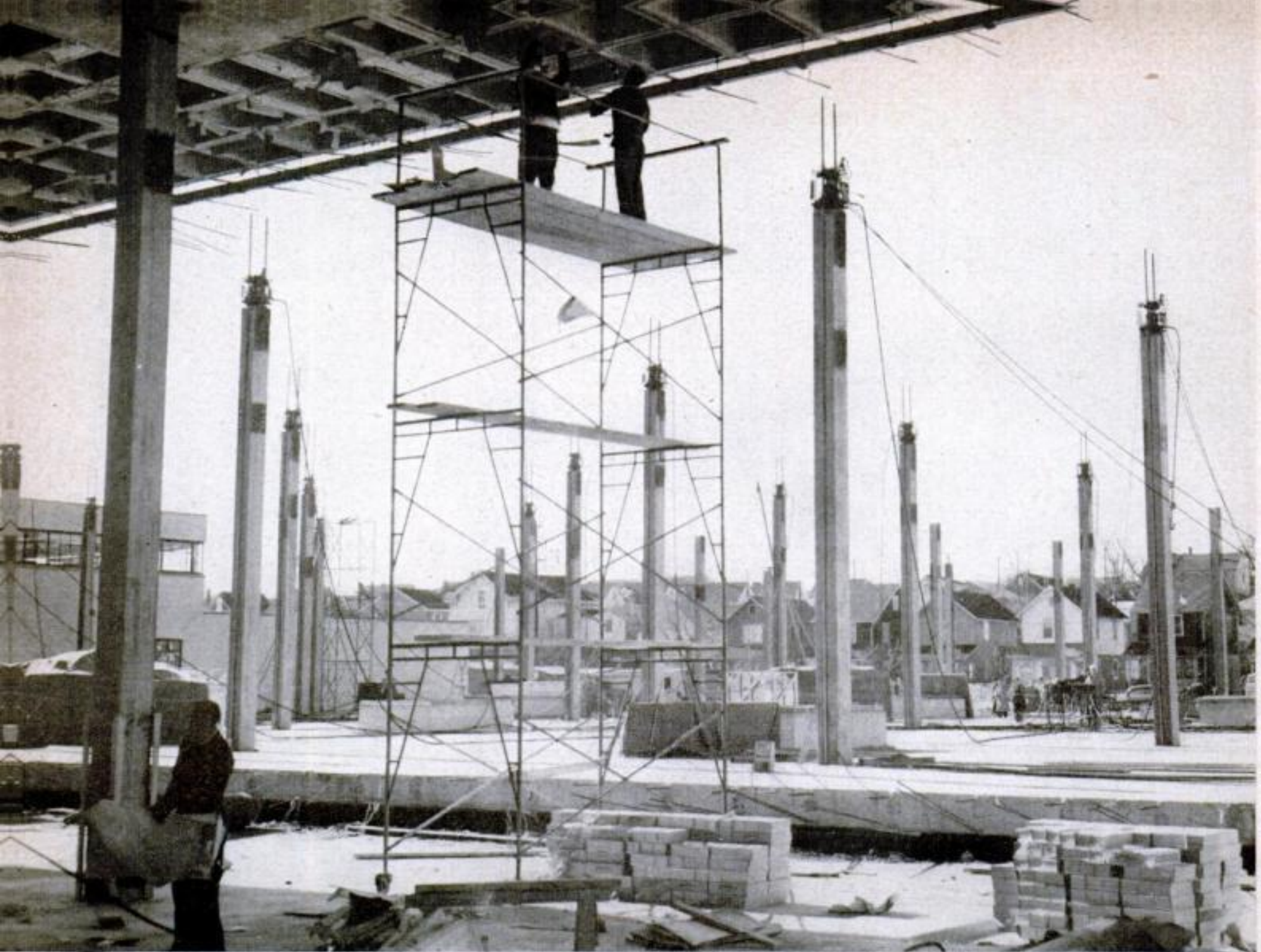
Super Corvette wears magnesium body and wheels

CHEVROLET has its "dream car" running—a hand-built experimental Corvette SS (S for super; S for sport). Some innovations: magnesium-alloy body and wheels, tubular frame and much aluminum in the chassis, cutting weight half a ton to 1,850 pounds. It has a 92-inch wheelbase, DeDion rear suspension, four-speed transmission, and a fuel-injected V-8 that develops more than 300 hp. from a 283-cubic-inch displacement.



Radio pill broadcasts what goes on in digestive tract

THE world's smallest FM radio station, put into the $1\frac{1}{8}$ -inch capsule at left so it can be swallowed, broadcasts news of a patient's health. A sensitive diaphragm at one end responds to pressure changes in the digestive tract. At right, the antenna that picks up the signals is held against Dr. Vladimir K. Sworykin, of the Rockefeller Institute, by Dr. John T. Farrar, of the Veterans Administration. The transistor device, now being tested, was designed by them and built by RCA.

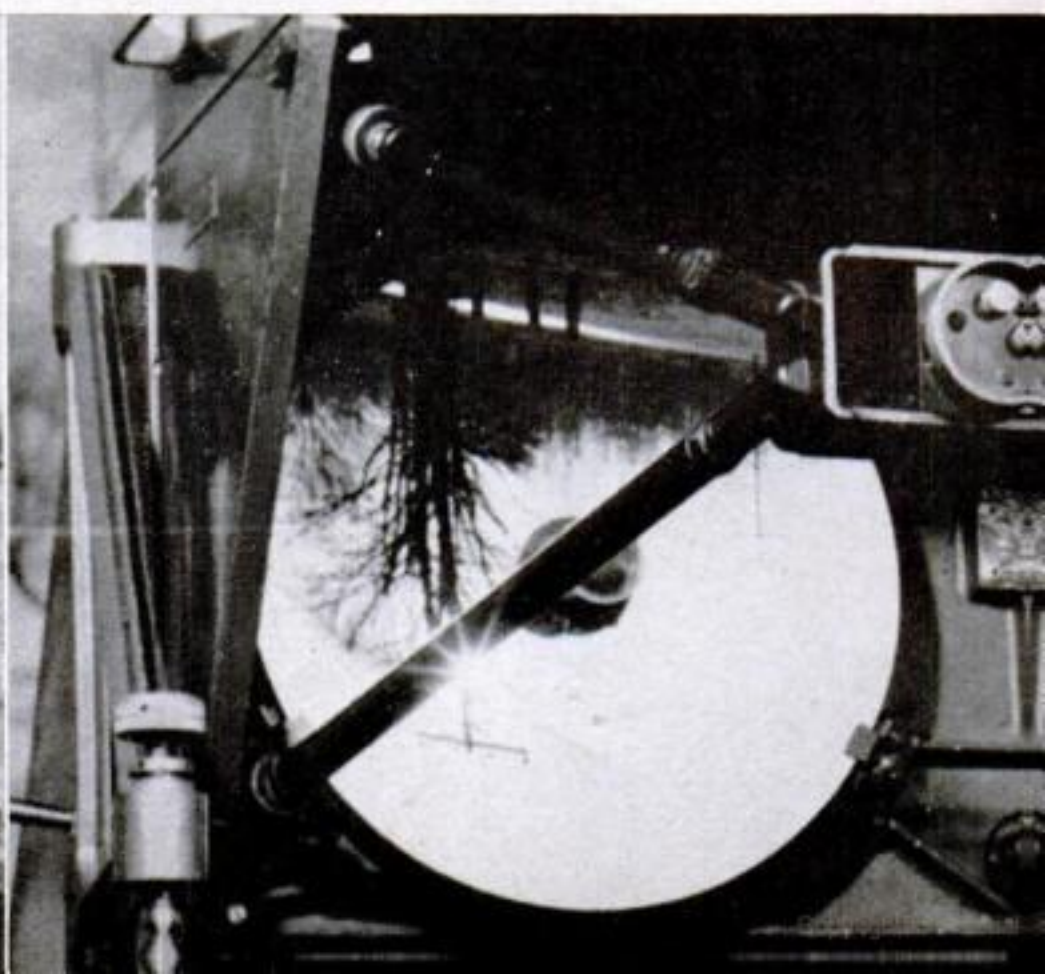
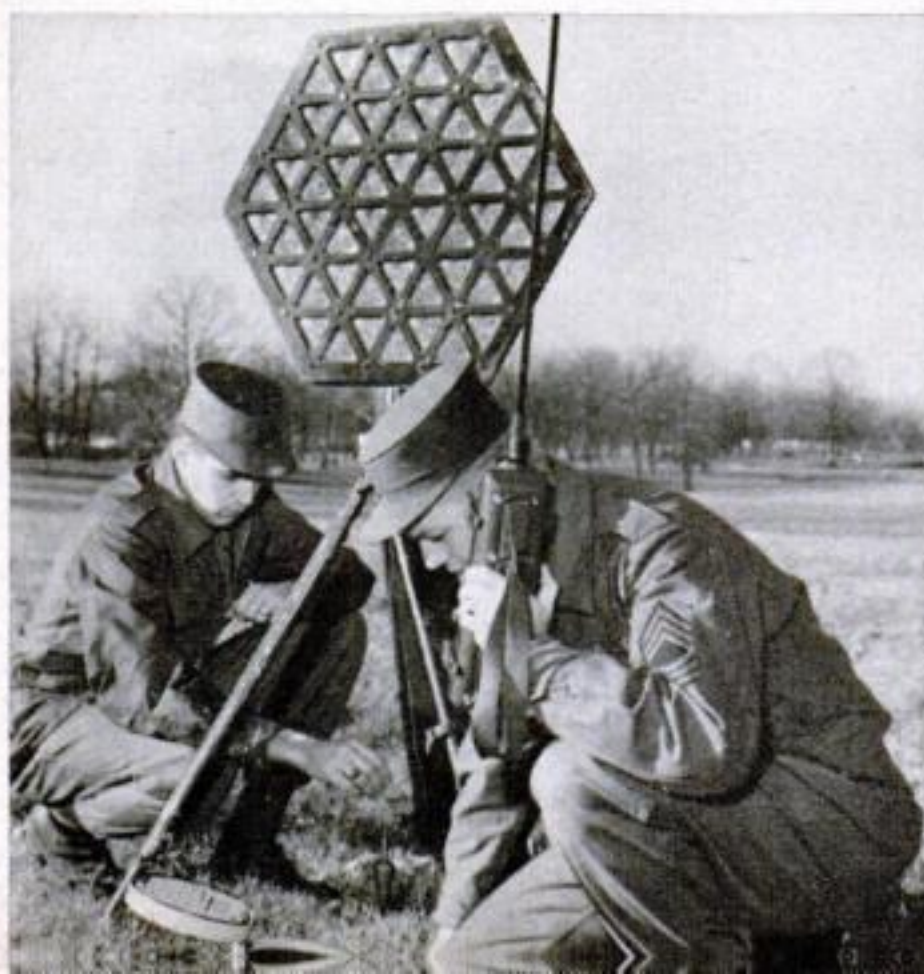


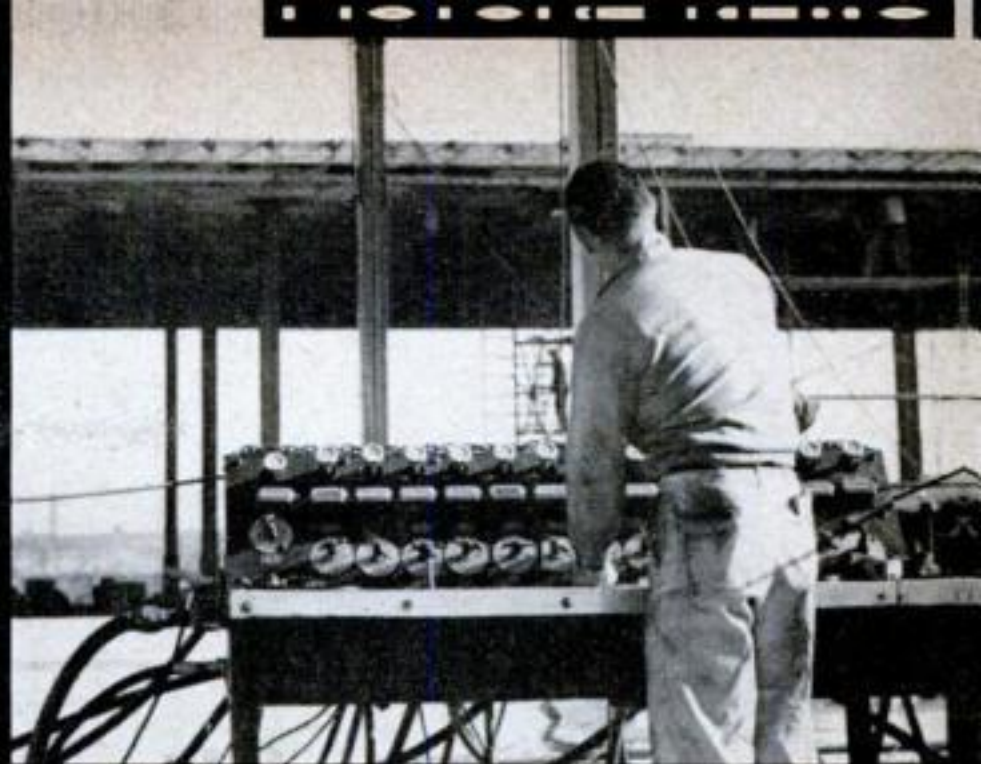
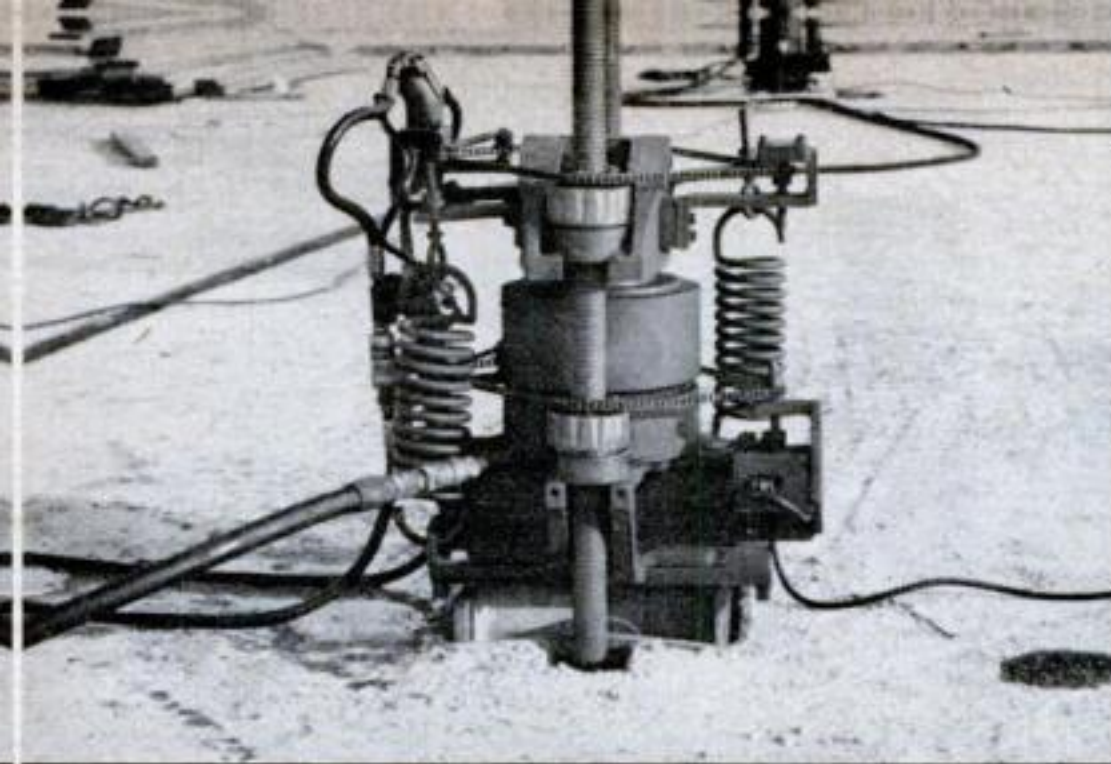
Skyhooks raise the roof on new factory

A THREE-QUARTER-ACRE, 1,400-ton slab of concrete, the center section of a huge roof, leaves the ground above as it starts its rise on "skyhooks" to the top of 26-foot supporting columns. One 900-ton end section, waffled underneath to save weight, is already in place, and another will

Electronic range finder works by speed of light

OPERATING surveying equipment developed by Army Engineers at Fort Belvoir, Va., the master sergeant at far right gets a precise distance measurement from a geodimeter. This electronic-optical instrument tells how

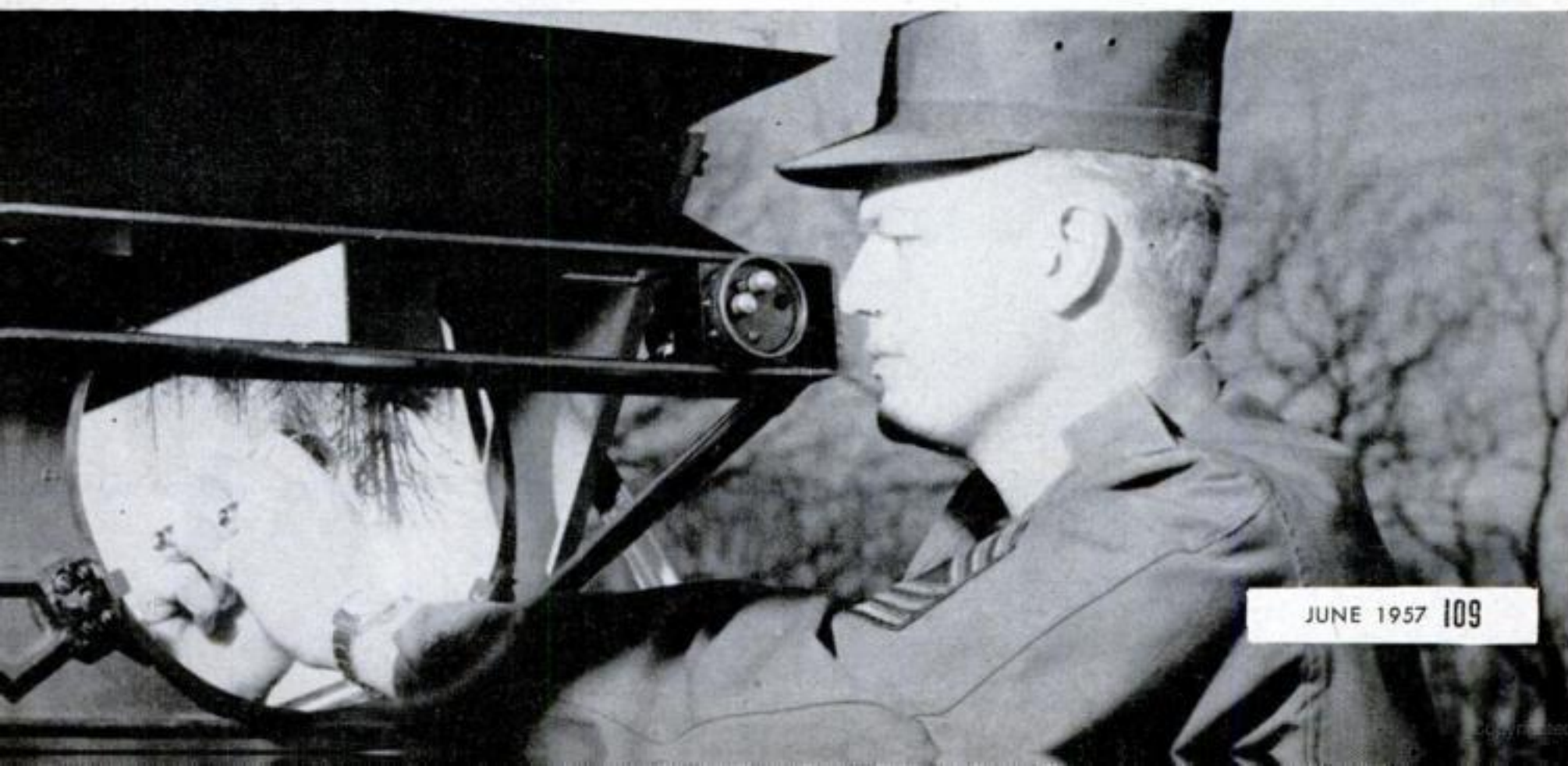


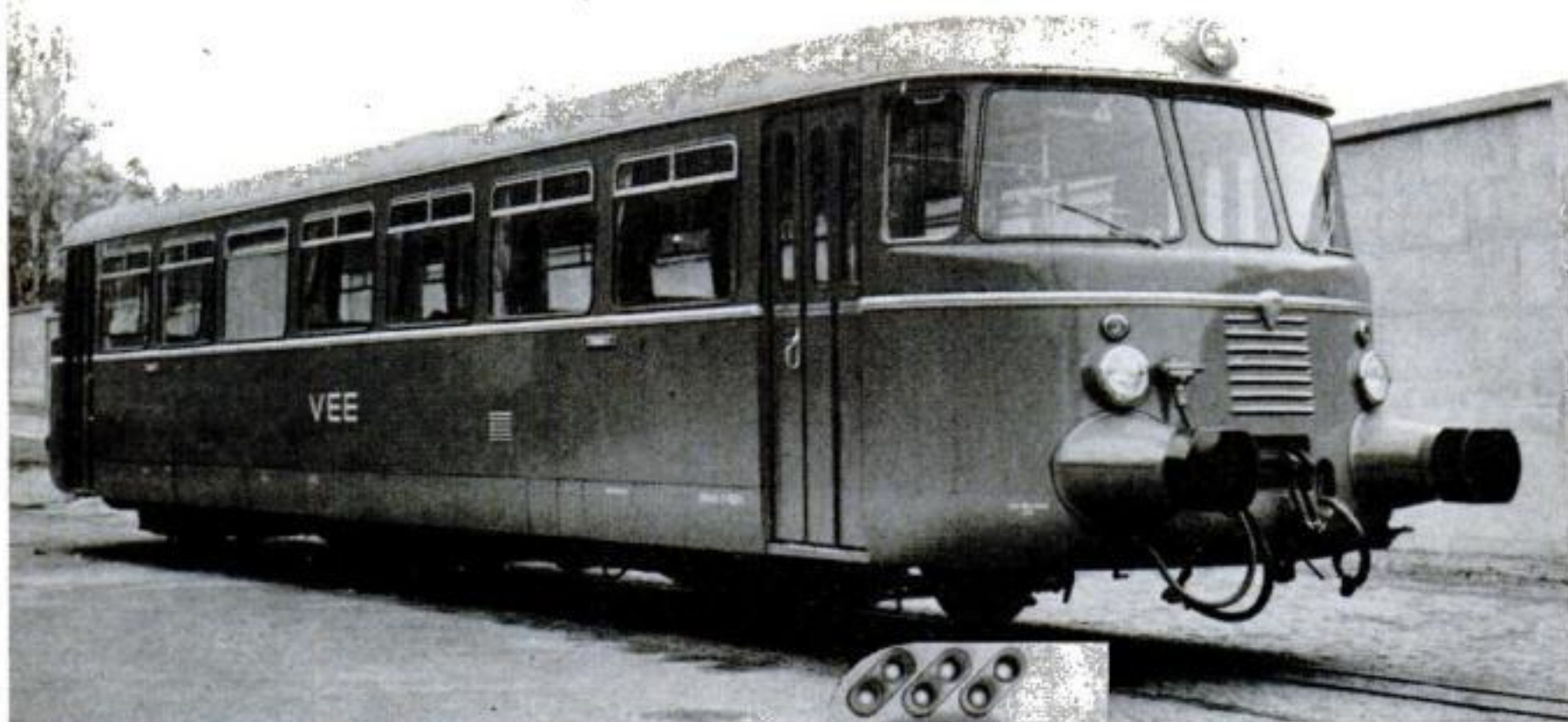


follow. Gaps between the roof sections are later filled in with concrete.

Hydraulic jacks (one is shown at upper left) perched atop the columns turn long, threaded rods that fit into the roof slabs. Operating pressure is applied gently from the console at upper right for even lift. The completed plant, designed by Powers & Kessler, New York, for Standard Tool & Manufacturing Co., Lyndhurst, N.J., is shown above.

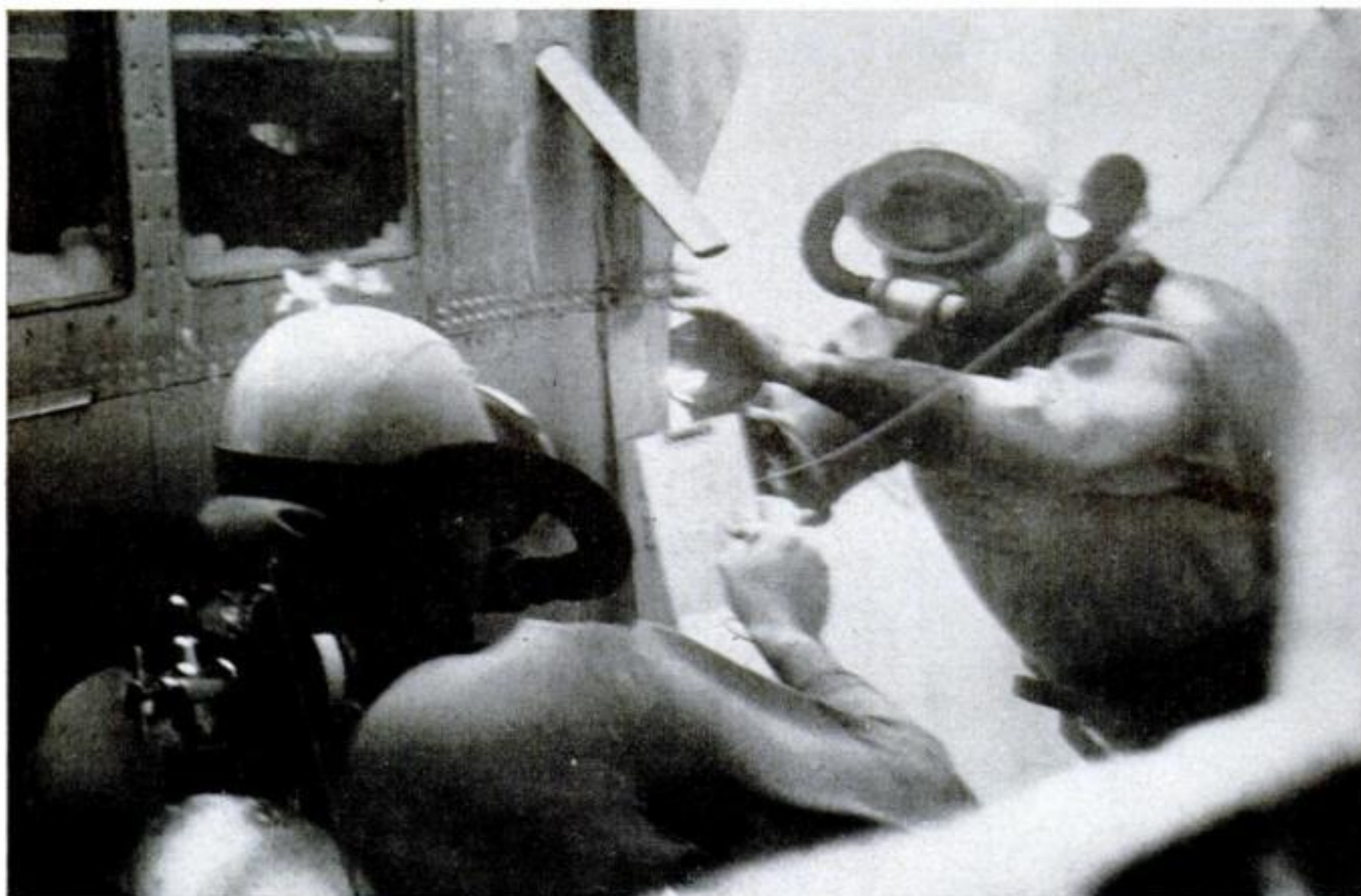
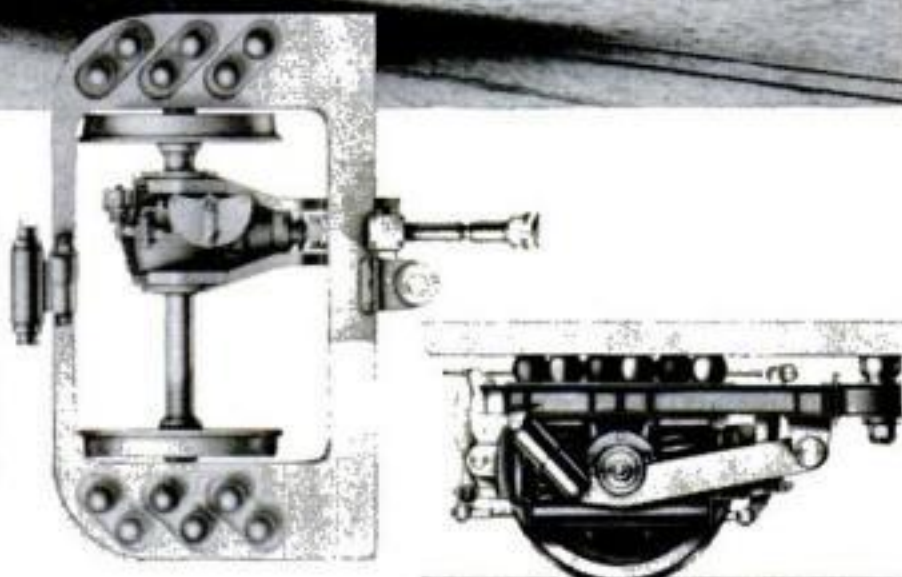
long it took a beam of light to travel from the 54-bank prism at left, and converts the figure to units of distance. The walkie-talkie transmits temperature and altimeter readings to the geodimeter site.





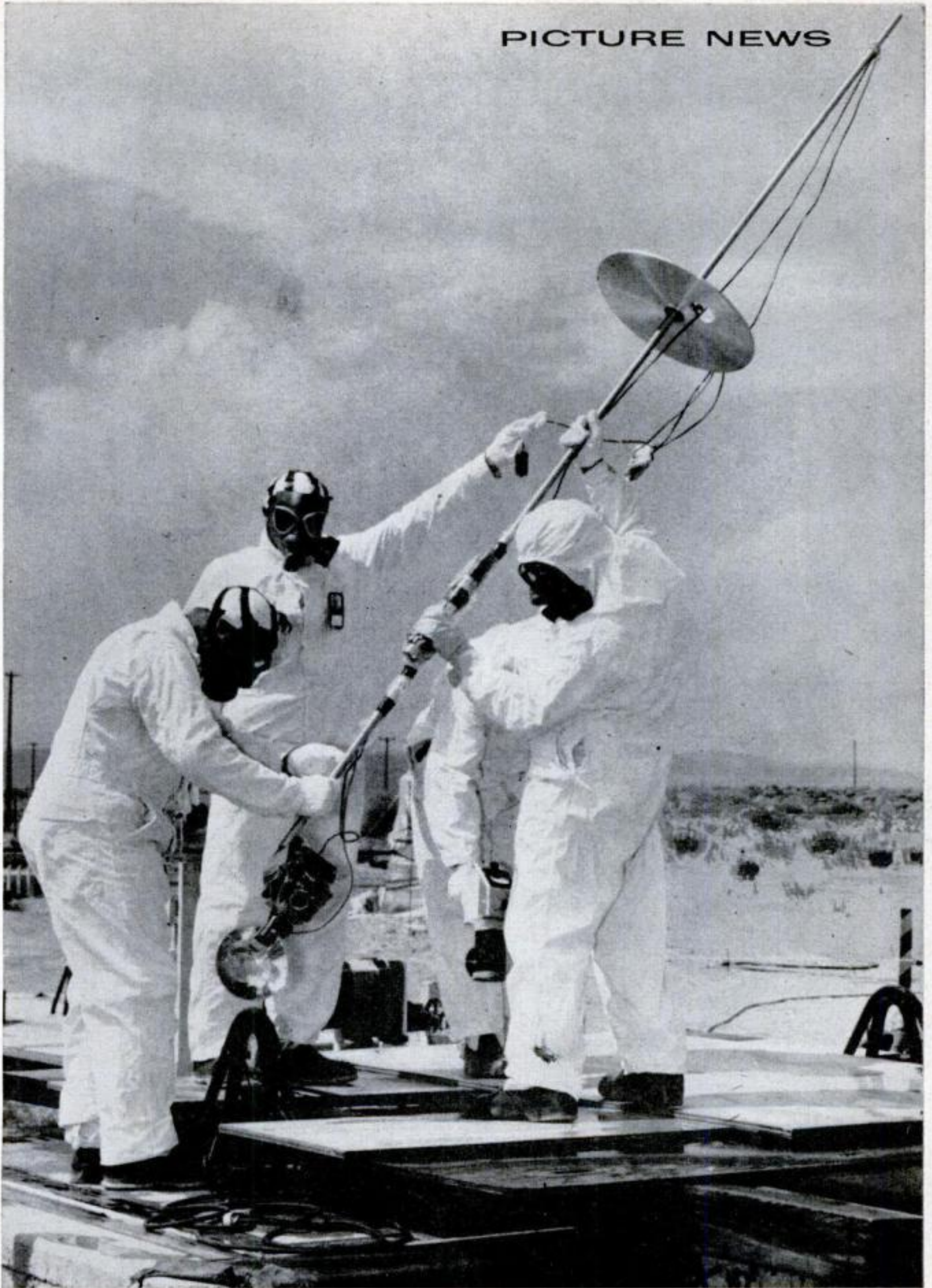
Rail car rides on four wheels

TWO-WHEEL, spring-suspension trucks that automatically recenter themselves on the rail roll this long German car on its way, eliminating costly four-wheel trucks and saving track maintenance. The weight of the diesel-powered coach is carried on rubber-ball rollers (drawings at right) that dampen wheel noise.



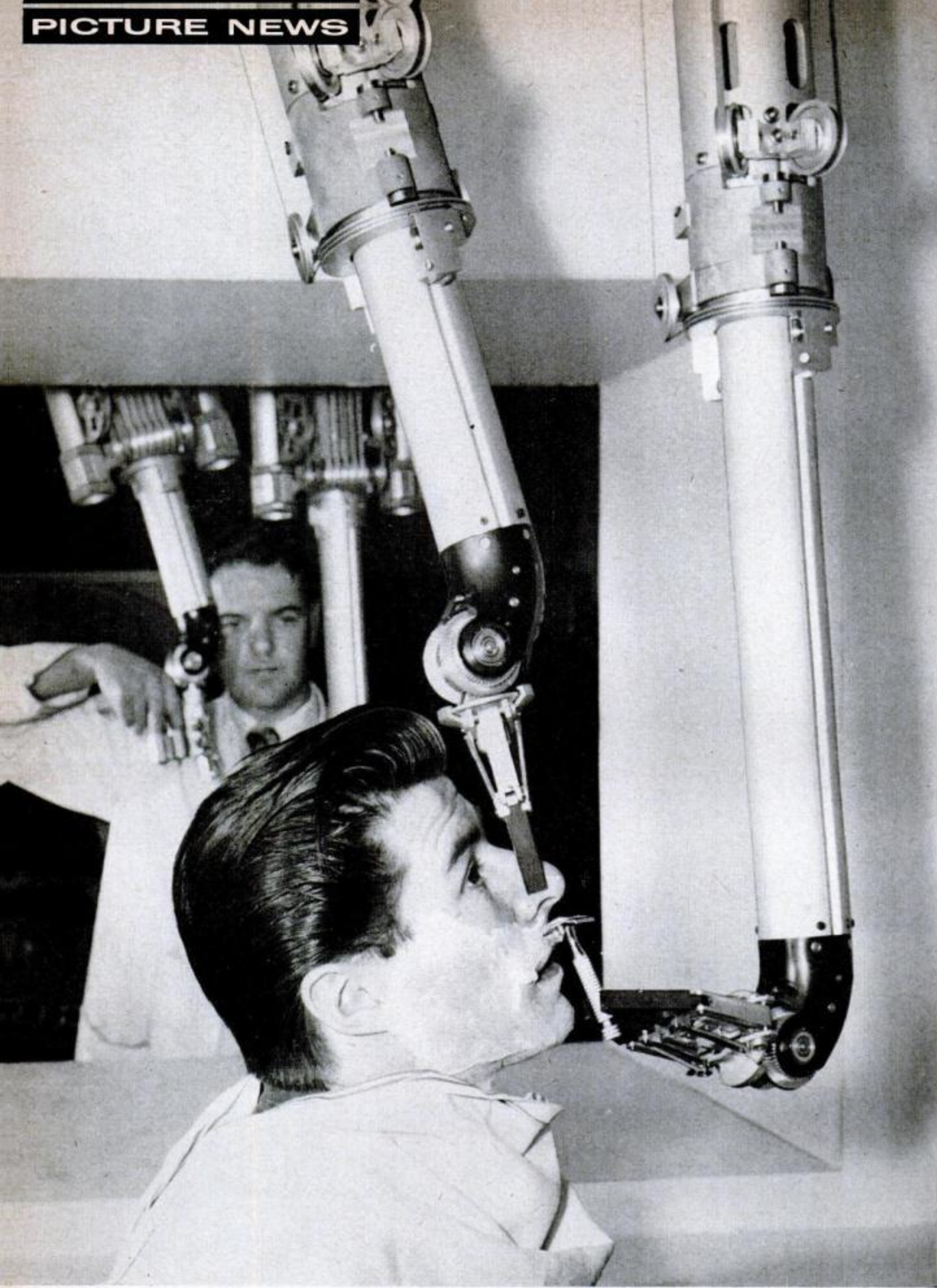
Skin divers test pressurized plane cabin in water tank

THE number of flights at 35,000 feet that a C-130 transport's pressurized cabin can stand without failure is tested by the Air Force under water. Here two skin divers check for hydrostatic fatigue in a 270,000-gallon steel tank at Marietta, Ga., after 20,000 simulated flights.



Camera on pole takes photos in radioactive-waste tank

To GET pictures inside a "hot" tank emptied of radioactive waste, General Electric technicians at Hanford, Wash., mounted an old copy camera on a steel pole. Flash and shutter were tripped by solenoid. The disk shield was calibrated to get shots covering a full 360 degrees.



Delicate mechanical hands shave by remote control

IN A demonstration of precision tasks performed by remote control, British technicians showed this shaving stunt. Like "master slaves" in the U.S., their device was developed for long-range research with radioactive substances. It duplicates every movement of the operator's hands.

How Did Your Car Get Its Name?

EVERYONE knows that the Ford is named after Henry Ford, but not one person in a thousand knows how the other American cars got their plain or fancy titles. Even most dealers haven't the foggiest notion how the names of the automobiles they sell originated. The quiz below gives four possible derivations for each name. Which one is right?—Herbert Kondo.

BUICK

1. A famous used-car dealer
2. A plumber
3. A Wall Street tycoon
4. An American inventor

CADILLAC

1. An Indian tribe
2. An American auto pioneer
3. A French military commander
4. A movie, "The Solid Gold-----"

CHEVROLET

1. A famous race driver
2. A French war hero
3. A famous French comedian
4. A popular song, "See the U.S.A. in Your Chevrolet"

CHRYSLER

1. The Chrysler Building
2. The Chrysler Corporation
3. Kreis Lehr, German auto tycoon
4. Walter P. Chrysler

DE SOTO

1. A Spanish explorer
2. A famous French race driver
3. A city in Missouri
4. A ship in the Italian Navy

DODGE

1. The Brooklyn Dodgers
2. The car's ability to dodge through traffic
3. Dodge City, Kan.
4. The Dodge Brothers

FORD

1. Henry Ford
2. Henry Ford
3. Henry Ford
4. Henry Ford

HUDSON

1. An English explorer
2. A river in New York
3. An American businessman
4. The world's second largest department store

JEEP

1. An animal in "Popeye the Sailor"
2. The J.E.E.P.—Joint Expeditionary Echelon Patrol of World War II
3. J. P. Morgan
4. A famous song, "Jeepers Creepers"

LINCOLN

1. Lin Kun, Chinese jinrikisha magnate
2. Lincoln Steffens, famed journalist
3. Lincoln, Neb.
4. Abraham Lincoln

MERCURY

1. The metal, mercury
2. The Roman god, Mercury
3. The planet, Mercury
4. Marie Curie, whose name was Americanized to Mer Cury

NASH

1. Ogden Nash
2. Charles W. Nash
3. Nashville, Tenn.
4. Nashua, a famous race horse

OLDSMOBILE

1. A famous song, "In My Merry Oldsmobile"
2. The fact that it's one of the *oldest* U. S. cars
3. Ransom E. Olds
4. Ye Olde Mobile Car Co., Detroit

PACKARD

1. Two brothers
2. Three brothers
3. Four sisters
4. Five spinsters

PLYMOUTH

1. Plymouth Rock, Mass.
2. A ship in the U. S. Navy
3. Plymouth Rock chickens
4. Plymouth, England

PONTIAC

1. An Indian tribe
2. An Indian chief
3. A city in Michigan
4. A river in the eastern U. S.

STUDEBAKER

1. A studious baker
2. An Indian tribe
3. Two 19th-century wagon builders
4. A family of Quaker pioneers

WILLYS

1. A former U. S. Ambassador to Poland
2. An ingenious auto inventor
3. A chemist
4. A POPULAR SCIENCE editor

Please turn the page to find the answers

JUNE 1957 113

Your Car's Name . . . Answers to quiz on preceding page

Buick was named after (2) a plumber, David D. Buick, who became an auto pioneer and built the first Buick. Just before he died, Buick was a clerk in Detroit.

Cadillac honors (3) a French military commander, Antoine de la M. Cadillac, who founded the city of Detroit in 1701.

A famous race driver (1), Louis Chevrolet, has the **Chevrolet** car named after him. The song, "See the U.S.A. in Your Chevrolet," came later.

The **Chrysler** is named after (4) Walter P. Chrysler. So are the Chrysler Building and the Chrysler Corporation.

De Soto honors the pioneering spirit of (1) Spanish explorer Hernando De Soto. He discovered the Mississippi.

Dodge got its name from (4) the Dodge Brothers Horace and John, early automobile manufacturers.

Ford—you're absolutely correct!

Hudson is named after (3) a prominent American businessman, Joseph L. Hudson. So is the second largest department store in the world, Hudson's of Detroit.

Any World War II veteran can tell you that the **Jeep** got its name from (1) an animal in "Popeye the Sailor."

Lincoln honors (4) Abraham Lincoln. The car was first built in 1921 by Henry

Leland, who was a great admirer of Lincoln. So were Henry and Edsel Ford who bought the Lincoln in 1922.

Mercury was named after (2) the Roman god, Mercury, noted for his speed as the messenger of the gods.

Nash got its name from (2) Charles W. Nash, one-time president of Buick, who in 1917 bought the Jeffery car and renamed it. From 1900 to 1914 the Jeffery had been the Rambler.

Oldsmobile honors (3) Ransom E. Olds, as does the Reo (R.E.O.) line of trucks. "In My Merry Oldsmobile," by Gus Edwards, was a hit song in 1905.

Packard is named after (1) two brothers, James and William Packard, noted pioneers in the auto industry.

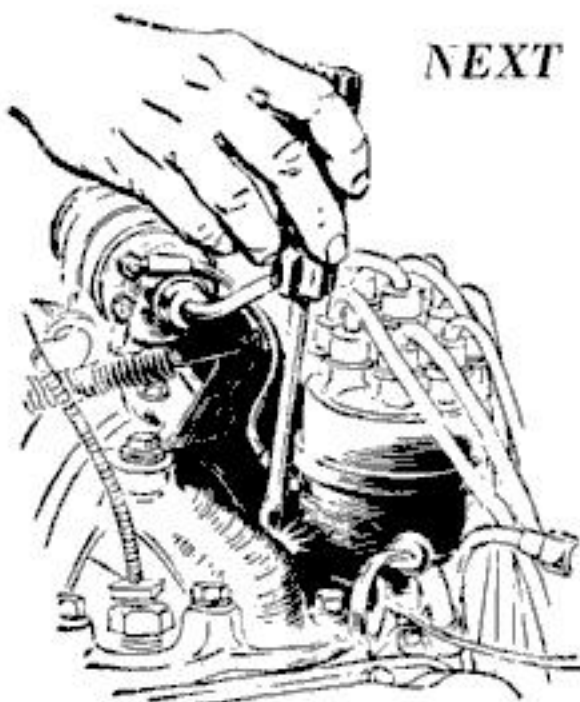
Plymouth honors (1) Plymouth Rock, Mass., and the pioneering spirit of the Pilgrims who landed there.

Pontiac is named after (2) Chief Pontiac. So is the city of Pontiac, Mich.

The Studebaker Brothers (3), famous 19th-century wagon manufacturers, have the **Studebaker** named in their honor.

Willys is named after (1) the U.S. Ambassador to Poland (1930-1932), John North Willys, who was also an early auto manufacturer. He started the Willys-Overland line of cars. END

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NEXT MONTH'S BONUS BOOKLET

What to Do When Your Car Conks Out . . .

You'll feel safer with this valuable booklet in your car's glove compartment, whether you have a good deal of car know-how or none at all.

A quick-check chart helps you, first, to localize the trouble when your car goes dead. Then clear illustrations take you through step-by-step tests by which you can pinpoint the trouble, and make emergency repairs with only screwdriver, pliers and wrench.

New Ideas from the Inventors

.....



1 Buffer Shield Protects Riders. This plastic inner windshield might reduce injuries when short stops or crashes throw passengers against the glass. Fitted

to older cars, or built into new ones, the transparent, impact-absorbing plastic would be made resilient by air trapped inside and spring mounts.

2 Disposer Collects "Used" Gum. On the theory that people wouldn't drop chewing gum on floors or stick it under chairs if they had a better place to put it, this inventor has designed a collector can—with disposable inner bag—for use in theaters, planes, buses, and the like.

3 Cartridge Cools Picnic Drinks. Sealed in separate chambers, substances in this cartridge would mix when the cap was pierced. The resulting chemical action would absorb heat, cool the bottled drinks. The plastic tube would be discarded when the drink had chilled.



Please turn the page for more new ideas

More Inventors' Ideas



4 Holder Times Eggs. The level to which you filled this cooker would determine when the steam whistle blew, to signal that your eggs were done soft, medium or hard. The inner tray would have a wooden handle so you could conveniently lift out the eggs to serve them.



5 Bather's "Cap" Forms Wings. Fastened under the chin like this, these inflatable collars would hold a swimmer's head safely above water. Unhooked, they'd trail freely behind the bathing cap, where they would not interfere with free movement of the wearer's arms.

6 Cycle Kit Grows With Child. With these interchangeable parts, and an adjustable wrench and screwdriver, you could build a scooter or small tricycle for

a child, then enlarge or convert it as he grew bigger. The kit would contain combinations of forks, wheels and axles; reusable pedals, handle bars and seat.





7 Drill Shank Fits Any Chuck. Drills made with this tapered, star-shaped shank could be used interchangeably in a brace or electric drill. Having six points, the shank could be gripped firmly by the two jaws of a brace or the three jaws of a common drill chuck.

8 Holder Catches Ashes. You wouldn't have to worry about where to flick your cigarette ashes if you had a combination holder and collector like this. The slide-out receptacle would be suspended below the shaft (right), or, when needed, could be extended as shown—or even slipped off and used as a pocket ash tray.



9 Dressing Room Attaches to Car. With this portable, curtained booth bracketed to your car, you could change clothes at the beach in privacy and comfort. Adjustable flanges on the curtain-supporting arms would hook into the upper and lower channels of car window.

The following patents have been issued on these inventions:
 1. Patent No. 2,757,040 to Roger T. McLelland, Richmond, Va.;
 2. No. 2,757,859 to James H. Holland, Marion, Mich.; 3. No. 2,746,265 to Evan D. Mills, Los Angeles; 4. No. 2,716,376 to Norman W. Halsey, Jackson Heights, N. Y.; 5. No. 2,766,466 to Lamar F. Johns, Pottsville, Pa.; 6. No. 2,768,834 to Roland Wilson, Washington, D. C.; 7. No. 2,766,791 to Hugh P. Givens, Newport, Va.; 8. No. 2,706,484 to Percy L. Tiller, Richmond, Va.; 9. No. 2,770,244 to Nathan Carson, Houston, Texas.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

Who Owns

Outer Space?



THE ancient Romans claimed the airspace over their land all the way to "heaven." But that concept is now as old-fashioned as the toga. We know that a cone of space extending outward from the U. S. would sweep the far heavens at a fantastic rate of speed as the earth rotates, and that whole galaxies would alternately pass through the cones of first one nation, then another. Today, a nation's sovereignty is generally conceded to extend upward only to the limits of the atmosphere (seven miles).

Not everybody is happy about this, however. For instance, Oscar Schacter, Director of the United Nations General Legal Division, says that each nation's sovereignty should extend to the altitude where aircraft can be sustained in flight.

Andrew G. Haley, chairman of the board of the American Rocket Society, says the limit should be where absolute pressure drops to zero (about 100 miles). And Dr. John C. Cooper, writing in the *International Law Quarterly*, suggests: You own as far up as you can control.

But they all agree that the nations of the world must settle the sovereignty issue. No space laws can be written until then—or solid claims laid to lands on moons or planets.

AS FOR space itself, most jurists agree that it will remain free for use by all nations, just as the sea is free today.

What about laws of navigation, and jurisdiction over crimes in space, such as piracy? According to Rear Admiral Chester C. Ward, the Navy's Judge Advocate General, such laws will probably evolve in the same way our sea laws evolved—by consent among nations.

That is why our IGY space satellite program is of such tremendous importance. We could have caused an international crisis with our 21-inch satellite because it is going to violate the sovereignty of a dozen nations as it spins through the lower reaches of space. But 50 nations have already assented to the program, thereby making the satellite "legal" under international law.

Acceptance of the satellite, however, establishes a precedent for only one thing: freedom of space travel. Deciding who will own the planets and work their mineral deposits is another matter.

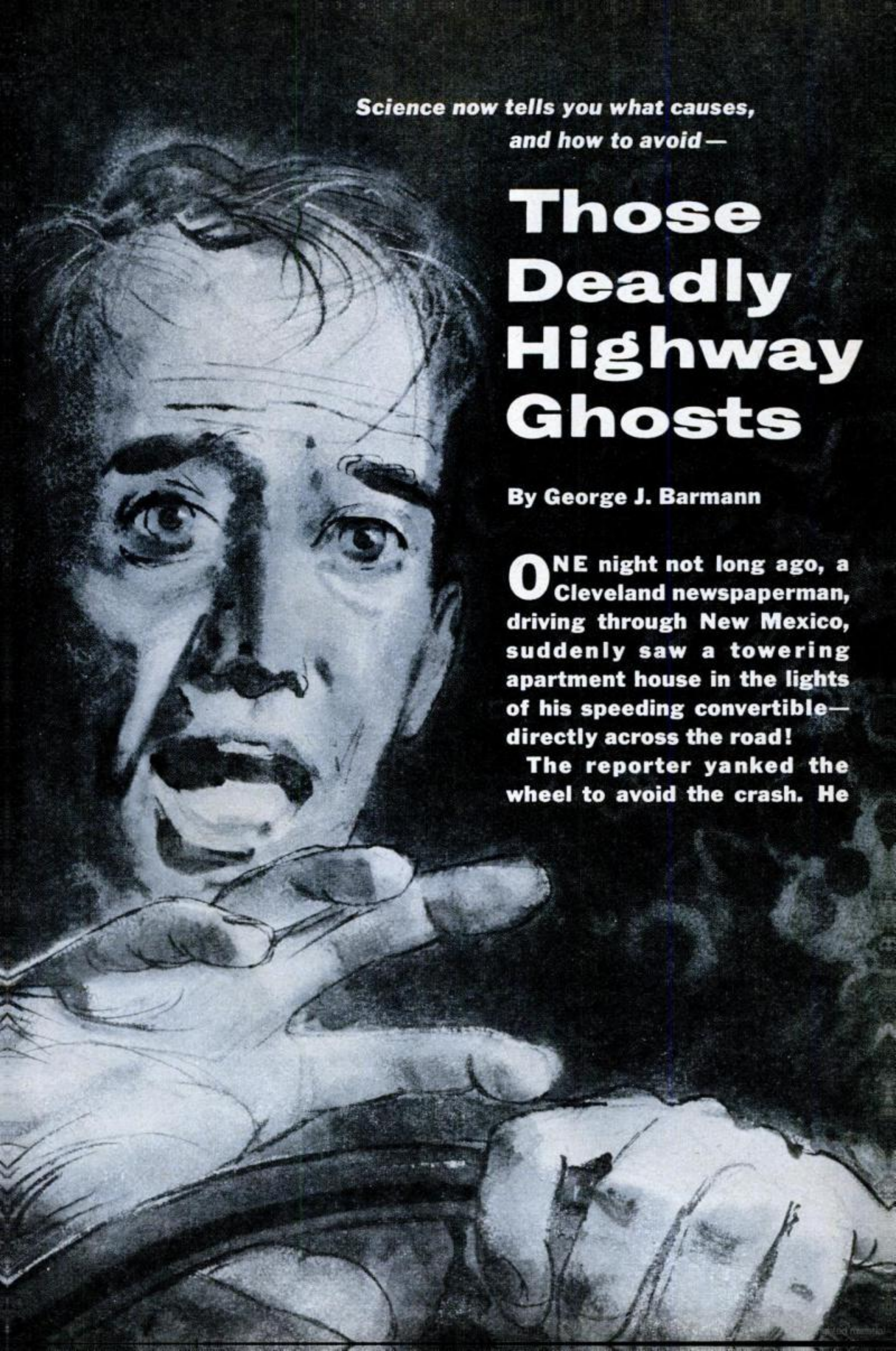
Custom, again, will probably decide, but the nations will be guided by history. Columbus, to establish a firm claim on Haiti, left part of his crew as an occupation force; planting the Spanish flag was not enough. And recently in a dispute between Norway and Denmark over Greenland, the Permanent Court of International Justice at The Hague said that establishing a claim required the "... intention and will to act as sovereign, and the exercise of such authority."

MOST jurists today believe that the planets will remain free for use by all. It just doesn't seem right that a government from earth should stake a claim on one of the heavenly bodies.

By the same token, mineral deposits will probably be "owned" by those who use them, the way oyster and clam beds are "owned" and worked on earth.

More and more world organizations are looking into these problems. The International Civil Aviation Organization recently began studying space law. The International Astronautical Federation has just been made an official consultant to UNESCO.

But some lawyers are impatient. Space travel is near, they believe. Sweeping new concepts of law must be developed—soon—to solve the problems that will crop up.—*Eliot Tozer.*



**Science now tells you what causes,
and how to avoid —**

Those Deadly Highway Ghosts

By George J. Barmann

ONE night not long ago, a Cleveland newspaperman, driving through New Mexico, suddenly saw a towering apartment house in the lights of his speeding convertible—directly across the road!

The reporter yanked the wheel to avoid the crash. He



DRIVING THROUGH NEW MEXICO, a Cleveland newspaperman suddenly saw a towering apartment house across the road.

managed to make a skidding, tire-shrieking stop just short of the brick-and-stone entrance to the building. Trembling, he looked again. There was nothing there.

"I sat in the car for a few minutes, and then I don't think I was ever so tired in my life," the reporter recalls. "I took it easy to the next town and fell into bed like a smokestack tumbling over."

Scientists could have warned him that he was heading for trouble. The newspaperman was hurrying to the West Coast on a quick holiday. He was driving too many miles without sleep. What he saw was a "highway ghost."

Many experts, working in university laboratories and out on the nation's roads to study and solve the complex problems of driving, report that a motorist's fatigue, often accelerated by "highway hypnosis," induces this weird phenomenon. They say that long, monotonous stretches of road, the purr of the engine, the ceaseless whir of traffic, plus the nearly effortless task of operating a modern car, and other factors, put a weary driver into a trance. He "sees" emergencies that do not exist.

These scientists and engineers can only guess the number of drivers who go smashing and spinning to their deaths

each year trying to avoid ramming into ghosts. But survivors, confiding to researchers and friends, tell chilling stories:

An upstate New York stock farmer, fond of county fairs and the harness racing at Goshen, was driving home from a Farm Bureau meeting late one night. Spring plowing had been robbing him of his normal rest.

"I was coming pretty fast down the road when I went into this curve," he recalls. "There, right in front of me, was a great big grandstand, with all its flags flying in the wind. I pushed the brake as hard as I could. I'll bet I left \$5 worth of rubber on the pavement. By the time I got out of the car, the grandstand was gone. There was nothing in the dark except the crickets."

A Nebraska insurance man, returning from a convention in Omaha, had been making coffee stops to stay awake. He had an important appointment the next day and wanted to get home by morning.

"As I came over a hill top, it happened," he says. "A big office building stood smack across the highway. I could even see the gold lettering on the windows and the bright glass doors. It looked just like the home office in Connecticut. Good thing I was using my seat belt . . . the stop would have put me through the windshield. I was really shaking. Then I looked again. There were only some lights down the hill."

DRIVERS who see strange sights may feel ashamed after they recover from their fright.

But scientists assure you that highway hallucinations have nothing to do with your mental competency.

Prof. Alfred L. Moseley, Boston consulting psychologist who was first to identify the phenomenon of the "highway ghost," has investigated hundreds of these cases for the Harvard School of Public Health. He reports that "hypnagogic hallucinations," as he classifies them, happen when you are on the border between being awake and asleep. He explains: "You are worn out, and you subconsciously want to stop. So your sub-

The battle of the billboards

With a multi-billion-dollar U.S. highway program already under way, a knockdown-dragout battle has been going on over the erection of billboards along the new roads. Favoring anti-billboard laws are such organizations as the AAA, the Natural Wildlife Federation, and the National Parks Association. Arrayed against the anti-billboardists are outdoor advertisers, motels and restaurants.

A prime issue in the debate has been the evaluation of billboards as a means of combating "highway hypnosis." The accompanying article tells you what science has learned about this strange phenomenon.

Next month, be sure to read two outstanding features: "How Doctors Now Use Hypnotism Safely," and "Which Are the Deadliest Days?" in July POPULAR SCIENCE.

conscious conjures up a reason—that imaginary obstacle—to get you off the road to rest."

Prof. Moseley, who has traveled thousands of miles on major highways in the United States and Mexico, observing and interviewing drivers, feels sure that the road phantoms are responsible for many mysterious traffic collisions and instances of automobiles suddenly running off the pavement.

SOME authorities, notably those at the Institute of Transportation and Traffic Engineering of the University of California at Los Angeles, recommend dramatic warnings for motorists. They suggest that certain monotonous stretches of road be marked with signs, cautioning against the possibility of hallucinations and other psychological hazards that may occur with prolonged driving.

The California scientists point to a section of U. S. 66, in western New Mexico, where in one year alone 900 accidents took hundreds of lives. The researchers found that most of those killed were from outside New Mexico. Police, stopping weaving autos, frequently discover overtired drivers. This is one place, for

example, where the UCLA men would post their signs warning of the dangers of road fantasies.

Fundamentally, these just-before-sleep



"I WAS COMING PRETTY FAST when I went into this curve . . . There, right in front of me, was a great big grandstand."

visions are similar to those that children have when falling asleep. Prof. Moseley notes, however, that in the case of a child, the only disturbance is a cry for mother about the big, black dog, or white horse, near his pillow. But such visions,

[Continued on page 226]

How you can fight "highway hypnosis"

Here are 10 suggestions offered by Dr. A. R. Lauer, director of the Driving Research Laboratory at Iowa State College:

1. Make frequent stops at regular intervals. Get out of the car, walk around a few minutes, take a nonalcoholic drink or a smoke.
2. Roll down a window to change the temperature in the car.
3. Chew gum or eat candy while you drive.
4. Change your speed every 15 minutes or so on long trips.
5. Eat moderately and of light foods before

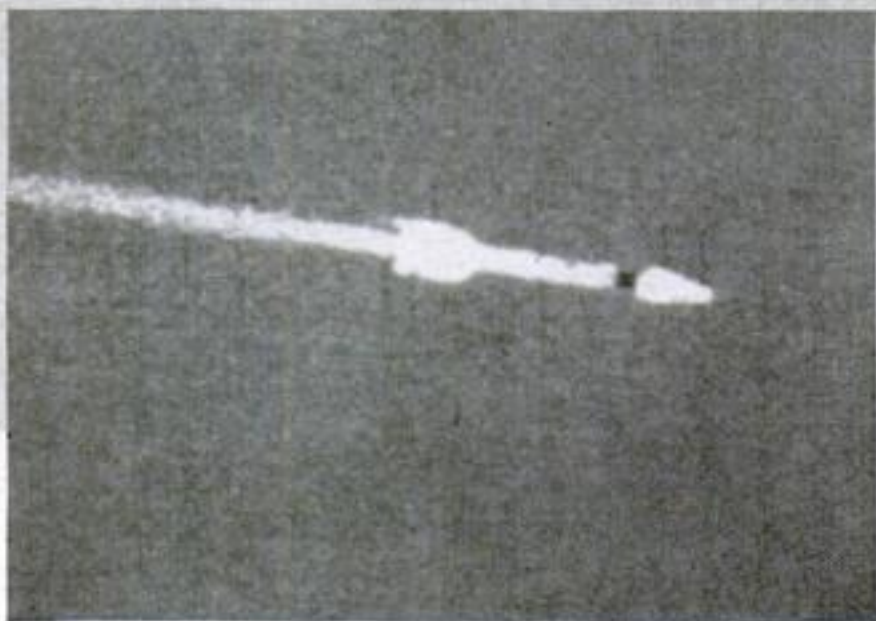
starting out and while you are on the trip.

6. Sit up straight.
7. Invite another driver along, when possible, and take turns at the wheel every hour.
8. Welcome back-seat driving, if it is not distracting; conversation often helps keep you attentive.
9. Read signs along the way.
10. Take off your shoes now and then and drive in your stocking feet.

But the best advice is this: Get off the highway and sleep!



New U.S.



The deadly Sidewinder buzzes when it senses an enemy jet's heat, then, like its namesake, hurls itself at the source.

Missile Strikes Like a Rattlesnake

By Jerry Hulse

IMAGINE that somewhere U. S. jet fighters are moving in on enemy bombers. The enemy pours on the flame in a frenzied effort to escape.

This could be his gravest mistake.

For now we possess a remarkable new air-to-air guided missile, the Sidewinder, that fairly feeds on fire, pursuing it with uncanny accuracy. Because of that, the foe's flaming afterburner is his own worst enemy.

Once this amazing missile announces to a fighter pilot, with an eerie buzz in his earphones, that it has detected an enemy plane's fire-spitting tail, the pilot pushes a button that unleashes it (singly or in salvos) from launchers beneath the wings.

It is useless now for the enemy to dive for cloud cover; there is no escape. Like a piece of iron attracted to a magnet, the flame-hungry missile zeroes in for the kill, withstanding from 10 to 14 G's in tight pursuit, striking at a speed

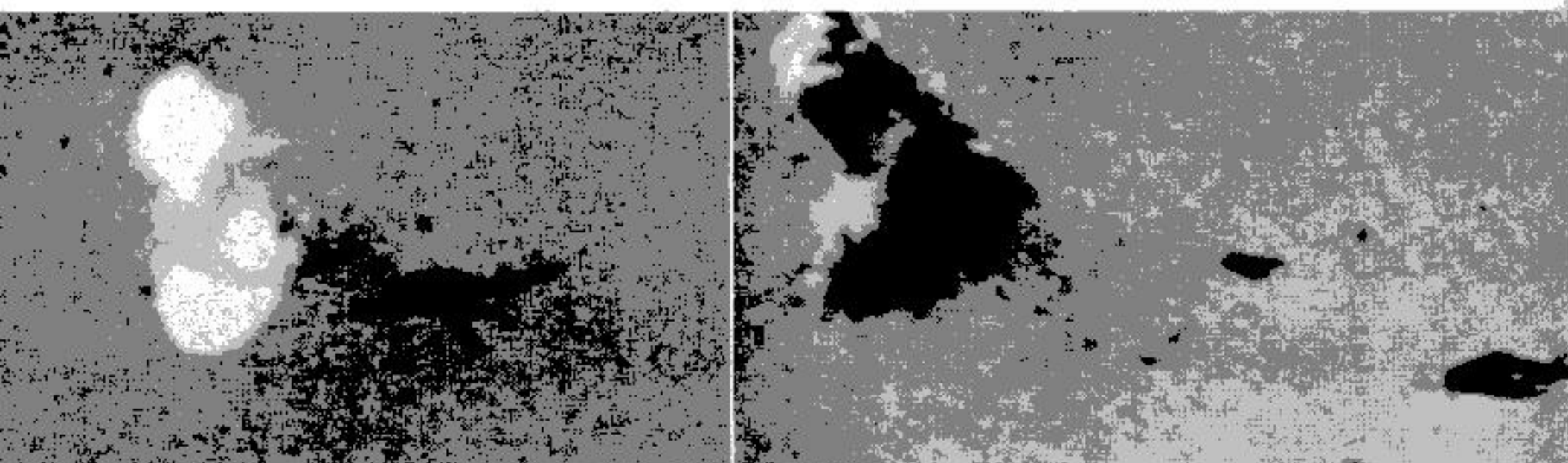
more than twice that of sound. So accurate is its aim that it will usually wham right up the tailpipe of the jet it has sought out.

The Sidewinder was named for the deadly rattlesnake native to California's Mojave Desert, where the missile was developed. Like a rattler, it strikes when it senses alien heat, hurling itself unerringly at the source of the heat. Again, like the rattlesnake, it sounds a warning before uncoiling its force.

Strictly speaking, it is not heat *as we know it* that attracts the Sidewinder, but the infrared rays that are a product of heat. The hotter an object is, the more infrared rays it gives off. So, in effect, the hotter a target is, the more surely does the Sidewinder find its way to it.

The slender, blunt-nosed missile is nine feet, five inches long and a bit over four inches in diameter. It weighs 155 pounds. The heart of its guidance system is in its four-inch plastic nose, where a "tracking telescope" seeks out the infrared radiation emitted by hot machinery

Below, a Sidewinder "homes" on a flare-burning drone two miles away and blows it apart.



FIXED FINS

A close look at a Sidewinder

and homes on it to strike with fury.

This infrared seeker will even chase a piston-driven airplane to kingdom come by locking on the plane's exhaust.

So sensitive is the Sidewinder's nose that a major test of the missile's combat readiness is to wave a flashlight before it. If it buzzes and its tracking telescope whips around to follow the light (whose infrared-producing "warmth" it can detect), it is all set to kill.

The Sidewinder is a remarkably simple weapon. One scientist describes it as "nothing more than an artillery rocket with a little steerage built into the nose." Unlike other air-to-air missiles, the rocket of the Sidewinder is actually part of the airframe.

While other guided missiles are jam-packed with electronics, the Sidewinder contains only seven vacuum tubes—no more than a good table radio. Further, it is constructed almost solely of aluminum, rather than strategic metals.

As a result, the Sidewinder is America's cheapest—as well as one of its deadliest—air-to-air birds. Mass-produced at \$800 a copy, about the same price as a rocket equipped with proximity fuse, it is capable of knocking down a \$10,000,000 enemy bomber.

Missile builders are usually reluctant to discuss price. But I am told that one radar-guided beast—also air-to-air—costs at least \$8,000. Some say this figure is far too conservative and that \$25,000 would be closer to the truth.

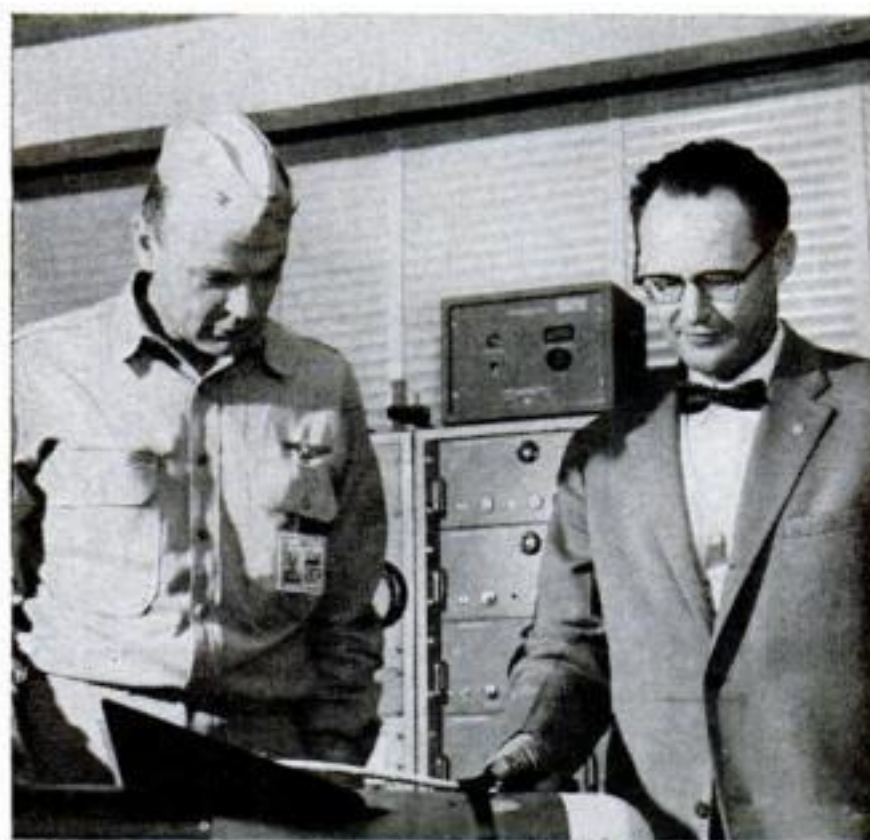
Little wonder, then, that the scientist who developed the Sidewinder was handed the highest cash award ever given under the Government Incentive Awards Program—\$25,000. In presenting

this award, Admiral Arleigh A. Burke, Chief of Naval Operations, said that nothing since the atom bomb had "done so much for the Navy" as the Sidewinder.

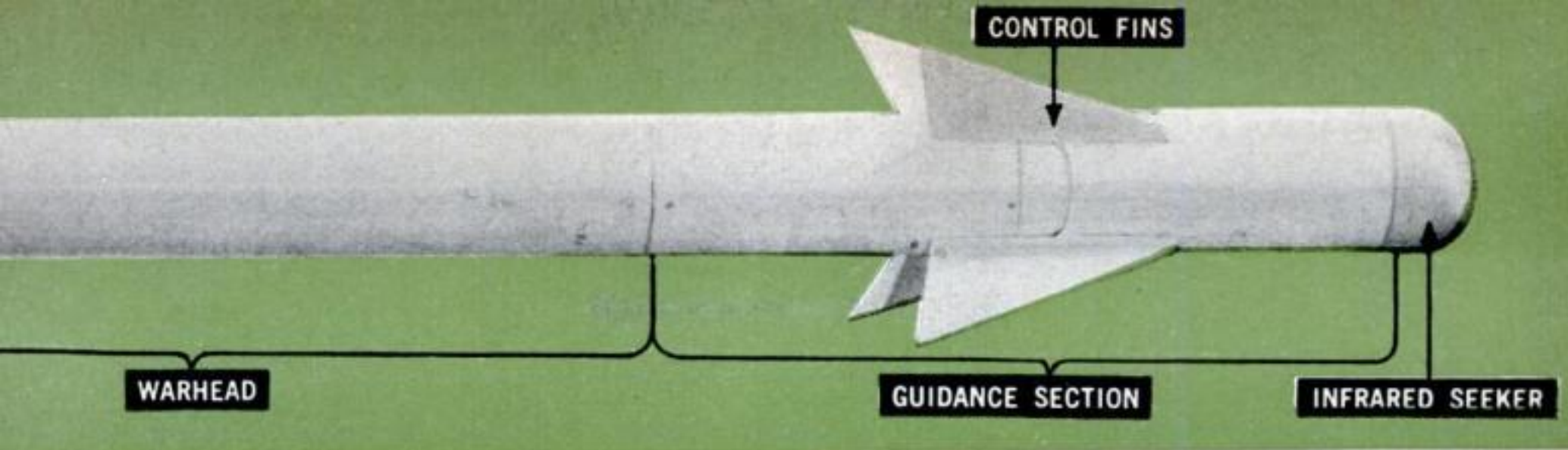
The weapon's 42-year-old inventor hardly fits the picture of a grim scientist whose missile monster would chill the vodka in the most intrepid Red ace. Peering from behind his horn-rimmed glasses, he seems more like a bashful college professor.

This gentleman is Dr. William B. McLean, technical director of the Naval Ordnance Test Station (NOTS)—encompassing an area greater than that of Rhode Island on the Mojave Desert at China Lake, Calif.

Rear Admiral F. S. Withington, chief of the Navy's Bureau of Ordnance, declared recently that Dr. McLean's achievement had saved the government



THE SIDEWINDER'S INVENTOR, Dr. William B. McLean (above, right), a modest and dedicated scientist, found inspiration for his missile designs in jet-powered toys and models.



an estimated \$46,000,000 just during the first year of production. Mainly, this figure is based on cost comparison with other air-to-air birds.

The Navy also points up the comparatively low development costs of the Sidewinder, something less than \$26,000,000. Costs were held to a minimum because much of the research was completed before Sidewinder was accepted as a Navy project.

McLean devoted three years, from 1948 to 1951, using 20 to 40 hours of his spare time each week, to the program. This in addition to his regular duties as then chief of the fire-control section at NOTS' experimental operations department.

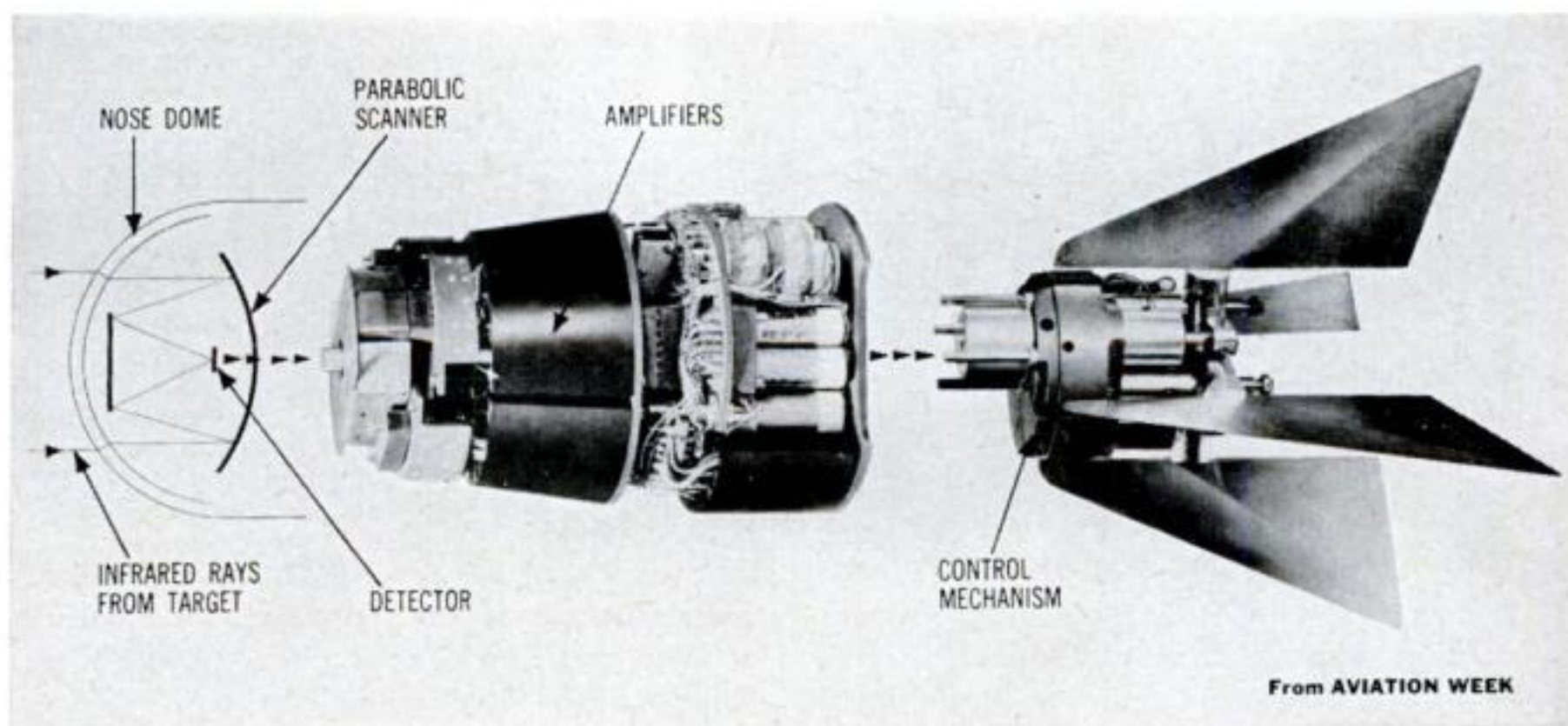
During this time McLean developed a hot interest in a power unit for model planes and toys that the British were

manufacturing. The explanation was simple:

He wished to power his missile with a slow-burning solid propellant. But missile builders were then interested mainly in fast-burning fuels that would give a sudden, swift boost. By chance, McLean learned that the British toys were powered with a slow-burning fuel. He ordered them by the dozens—so he could study their small fuel capsules.

He had to improvise a lot in those days. At NOTS there is no wind tunnel for testing missile models. So McLean uprooted his wife's clothesline pole, placed the missile model on one end and then stuck the whole works out the window of his beatup jalopy. A race-happy engineer named L. T. Jagiello drove the car at reckless speed across a nearby dry

[Continued on page 218]



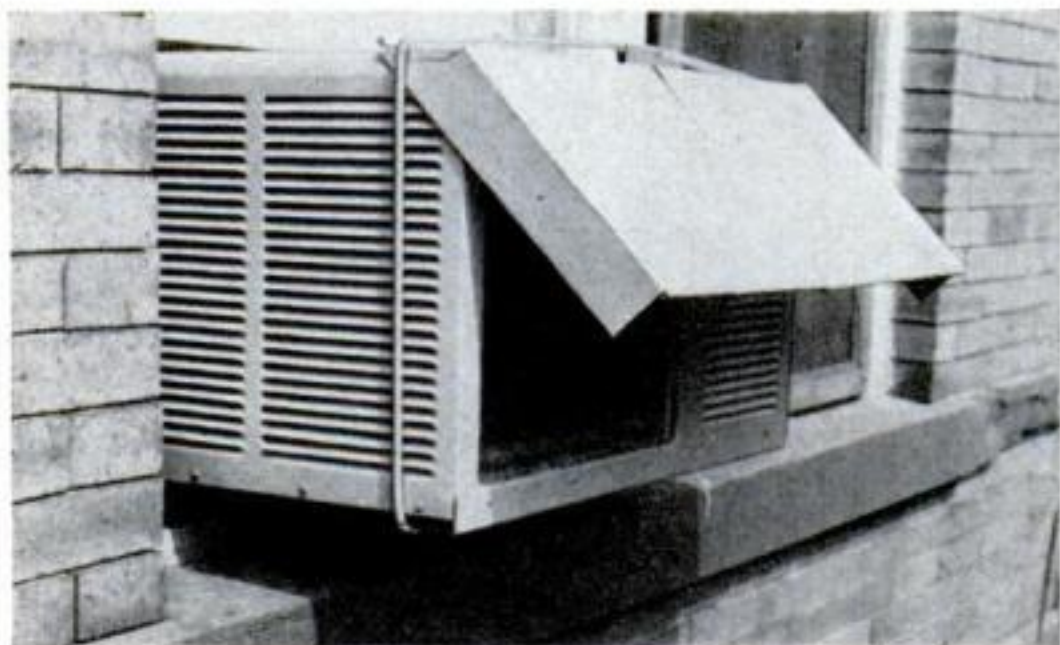
From AVIATION WEEK

AN INFRARED GUIDANCE SYSTEM, like that of the Sidewinder, contains elements like these. Infrared rays from the target are focused and "detected"—that is, converted into electrical sig-

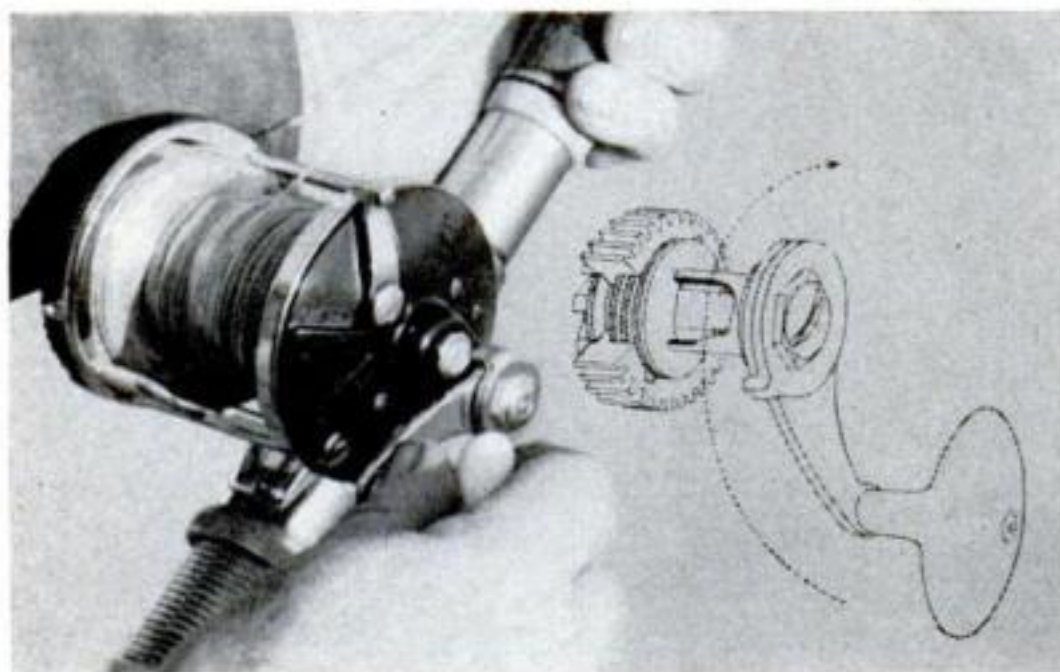
nals. These, amplified, power servo motors that turn the control fins and steer the missile. The system is light, small, simple and, unlike radar, doesn't tip an enemy off to its presence.

New Aids to Living

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1 Snap-on awning for air conditioners shades the condenser from sun, and protects it from rain. A spring hooked around the back of the room cooler snaps into a track on the adjustable awning to hold it in place. Cooling the cooler, says the maker, increases its efficiency so that it can handle from 10 to 20 percent more room space when laboring under direct rays of the sun.



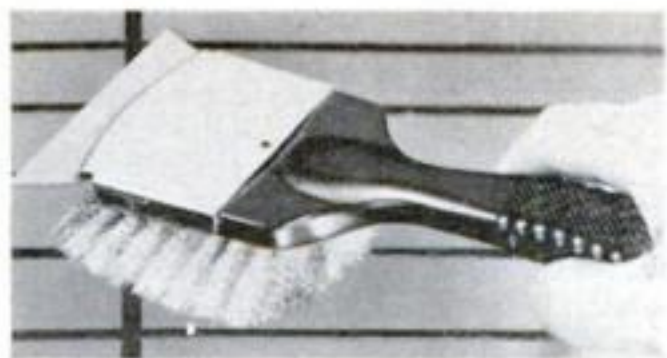
2 Starless-drag reel gives you variable control to match line tension while playing a fish. It works like a bicycle coaster brake. Alternate metal and fiber washers on a threaded gear sleeve apply braking pressure as the handle turns—said to be the first big change since the star drag's invention in 1911. A stop holds maximum drag below line breaking point. There are reels for lake, surf, deep-sea fishing.



3 Cabana for trailer dwellers has double walls of aluminum with a honeycomb core that makes them three inches thick. Wall sections and corner posts

interlock and are joined without screws, bolts or nuts. Even the roof is aluminum. The extra room can be disassembled and shipped, or carried in the trailer.

More information about the products shown on these pages can be obtained from: 1. Superior Co., 772 Sutter Ave., Brooklyn 7, N. Y.; 2. Montague-Ocean City Rod & Reel Co., A & Somerset Sts., Philadelphia 34; 3. Panelfab Products, Inc., 2000 N.E. 146th St., North Miami, Fla.; 4. Empire Brushes, Inc., Port Chester, N. Y.; 5. Lockey Products, 1429 N. Clark St., Chicago 10; 6. Weber Bros., 108 N. Jefferson St., Chicago 6; 7. Zonolite Co., 135 S. LaSalle St., Chicago 3; 8. Home Appliance Service, 2614 Wilson Blvd., Arlington 1, Va.



4 Barbecue brush makes short work of cleaning your outdoor grill. Flared brass bristles reach into corners and between rods, and a steel scraper attacks charred and burned-on foods.



5 Fireplace fork takes six franks at a time, clasps them between its tines so they can't slide out. A peg stored in the handle opens the hot fork.



7 Grease-thirsty chips of vermiculite under your briquets will soak up drippings and prevent flame flare-ups in outdoor cooking. They also act as a wick if lighter fuel is used to start the fire.



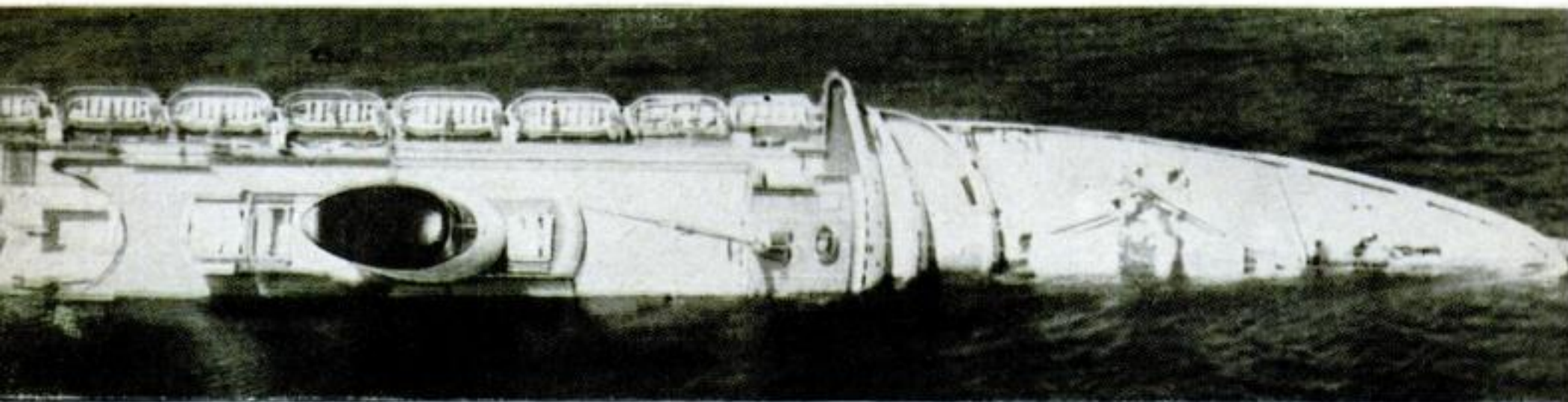
6 Covered barbecue kettle cooks meat faster. As a roast turns on the electric spit, dampers in the porcelain-enameled steel bowl and cover control both draft and smoke. The deep cover also keeps out dirt and insects, and prevents splatters.



8 Electric firemaker for sizzling-meat chefs works like a soldering iron. You can plug it into any 115-volt AC or DC outlet, poke its business end in between the chunks of charcoal, and leave it. No kindling is needed. The heating element in the tubing ignites the fuel in about the time it takes to toss a salad or form the hamburger patties.

New Life Rafts Defy the Sea's

Not even one of the Andrea Doria's port-side lifeboats could be launched when, on July 25, 1956, the Doria and Stockholm collided. The Doria at once listed 40 degrees to starboard and her port-side boats were too high and away from the water. Fifty lives were lost.



This recent catastrophe proved that a quick, efficient way of saving lives at sea was still to be discovered.

Now the British think they have it: a covered and insulated version of the common inflatable raft, incorporating many radically new features.



Davy Jones's locker was the classroom where experts studied the flaws in old-fashioned lifesaving methods.

Worst Terrors

By Gardner Soule

WISE in the ways of the sea, the British believe they have found some of the answers to why men drown when ships go down. Pains-taking study of hundreds of marine disasters has resulted in a new life raft, revolutionary in design, that could erase forever the tragic report: "Lost at sea, with all hands."

So sure are the British of their new rafts that last October they began to make them mandatory on all fishing vessels over 50 feet long. The rafts are now being installed on all Royal Navy ships. In the past few months, several dozen British passenger lines have put them aboard. And they are on the *Britannia*, the Queen's own yacht.

Both the U. S. Navy and Coast Guard carry inflatable rafts on many vessels—including the Coast Guard's North Atlantic weather-and-rescue ships. Overseas commercial airliners and Coast Guard rescue planes also have rafts, sometimes new covered ones. The soft rafts can be bounced against a floating plane without smashing and sinking it, as a metal or wooden lifeboat will.

British life rafts are the result of years of study that started before World War II and is still going on. They studied hundreds of disasters at sea: known disasters like that of the *Doria* and *Stockholm*; and unknown disasters—the stories of ships that vanish without a trace for no known reason. Like the *Nordic Star*.

THE *Nordic Star* sailed from Philadelphia just before last Christmas for Le Havre, France. A sturdy, 7,124-ton British freighter, she sent, on December 27, a routine radio message that she was in mid-Atlantic.

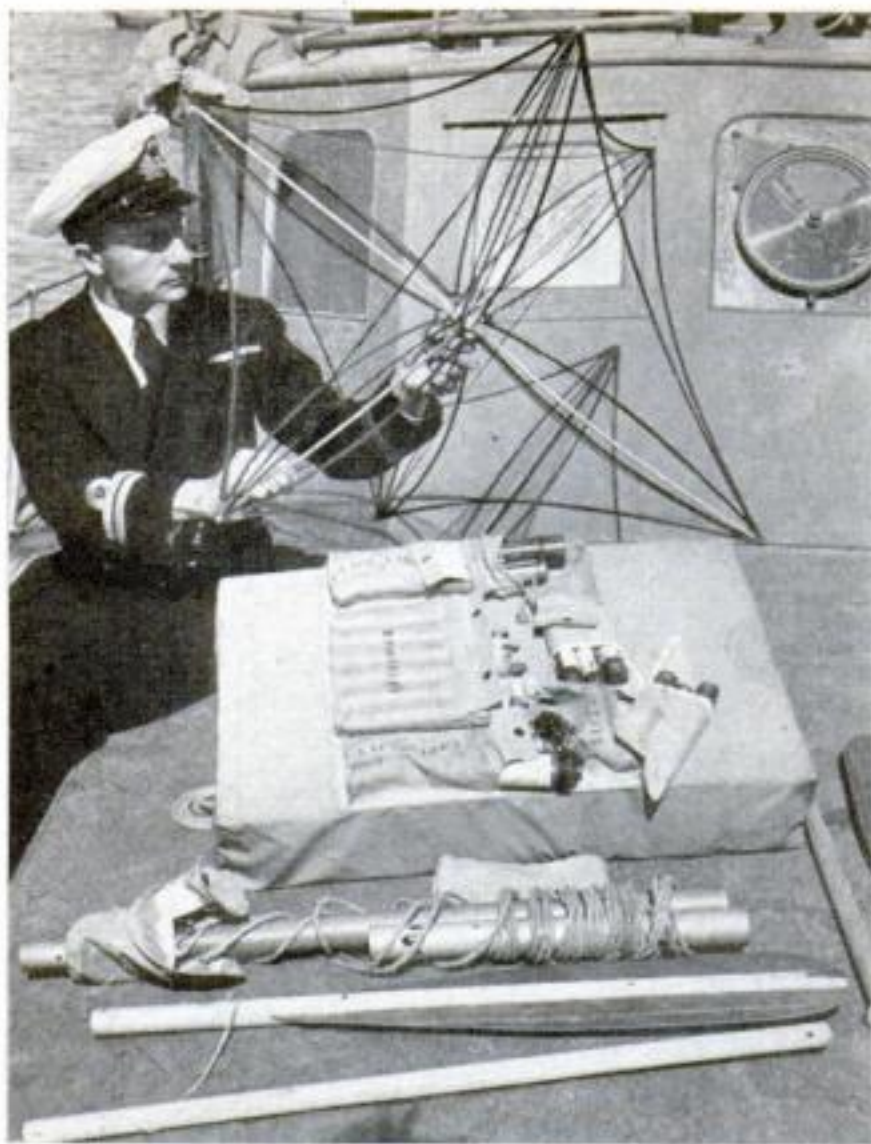
The next thing that was known about her was—nothing. She, and all her 35 men, simply disappeared. No SOS calls were heard. Search revealed no surface debris on her route. There were no life belts washed ashore, no messages in bottles, no bodies, no survivors. Nothing.

A week after the search for the *Nordic Star*, the skipper of the *Queen Elizabeth* reported that he had encountered something incredible near where the *Nordic Star* had disappeared: 70-to-80-foot waves. The *Nordic Star*'s owners gave as their opinion: "She must have been overwhelmed in that very bad gale after Christmas."

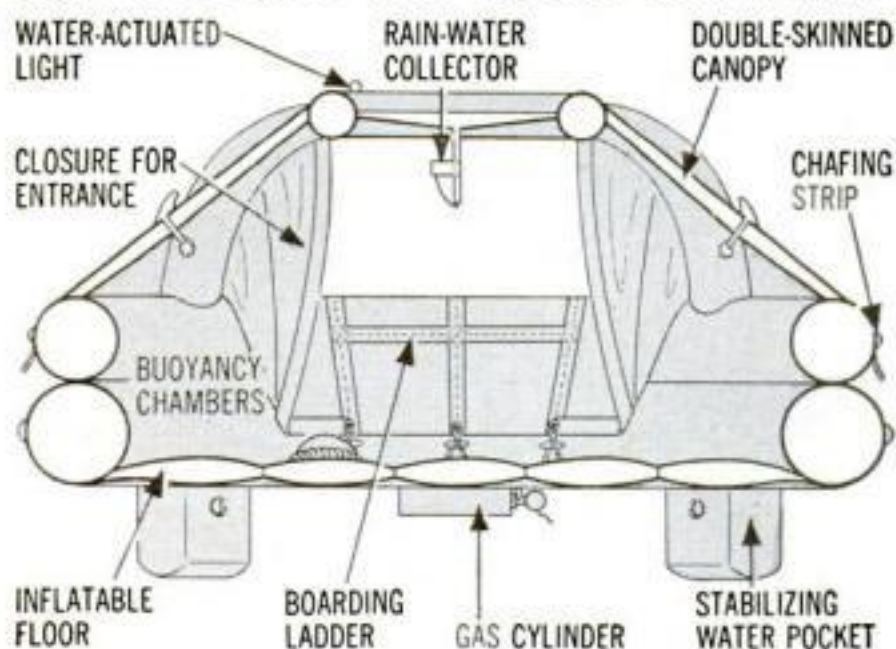
THUS did the *Nordic Star*, although she sent not a word herself, underline something already known: To be useful, any new lifesaving craft must have the seaworthiness and stability to ride the highest waves, must not overturn in the heaviest sea. The new rafts rarely turn over; they right themselves if they do. They snuggle into the sea, are far more stable than lifeboats. And a sea anchor, which the raft automatically puts out, holds it steady to the wind.

It is the North Atlantic that takes the most ships in complete mystery. Fishing and coastal vessels vanish—nine in a single storm in 1953, six in another in '54—in these waters. But this sea of missing ships is by no means content with small prey: The North Atlantic also drags down large, well-equipped, and fully manned ships.

Courts of Inquiry comb their records to find out what happened. To bring back the word from ships that didn't leave any, they sift every detail: plans of a missing ship, how she was built, what cargo she carried. They call endless witnesses: her builders, former members



RADAR TARGET (held by officer) is standard equipment. Paddles may be aboard, but survivors are advised to stay close to scene of sinking, where rescue craft can find them easiest.



DETAILS show how much rafts are improved over simple, open rafts of World War II. Used as silent assault boats in war, pneumatic rafts may now find their greatest use in peace.

of the crew, the men who prepared her for her last trip. Eventually, a Court suggests why a vessel vanished—and in doing so almost always provides a clue on how to improve lifesaving at sea.

A converted Liberty ship, the *Samkey*, which had survived wartime convoys, went down without a trace in 1948. The Court determined that probably her ballast had shifted suddenly and pulled her over on her side.

THIS was one of many indications that new rafts must be capable of being launched quickly. They are. Of rubberized cotton, they are folded and stowed in canvas valises. All you have to do is throw the valise overboard, simultaneously pulling an attached cord. The cord opens a gas cylinder. The raft bursts from its suitcase and inflates automatically in 30 to 100 seconds.

A former Brazilian battleship, the *Sao Paulo*, was the biggest of all to pull the disappearing act: 500 feet long, 83 in beam, 19,200 tons. She was being towed to a scrap yard in October, 1951, by two of the finest ocean-going tugs in the world, the *Bustler* and the *Dexterous*. In heavy weather, the towlines parted. Visibility was almost zero. The *Bustler* got her radar going at once. She never got an echo.

The Court's opinion: Probably the wind, blowing broadside against the *Sao Paulo*, had capsized her. Water had rushed in through her portholes and other openings. This disaster indicated that, if a sailor was to have any chance at all, life rafts should be stowed all over the ship—not, like lifeboats, all on



1 SECOND



10 SECONDS

In the sea, the raft emerges from its valise . . . It opens up and the tubes inflate themselves . . .

one deck—or all in one or two places. The new rafts, in their suitcases, can be festooned all over a vessel. In need, you are surer of having one at hand.

The British Anglo-Australian, which vanished, had every standard precaution against disaster: seven watertight bulkheads, double bottom, three radios, flares, rockets, good lifeboats, etc. The Court decided that she had too much weight (including ballast) amidships. Then, the Court thought, she was probably held high by waves fore and aft, and the weight amidships split her in two. It would not have been possible to launch lifeboats from either bobbing, lurching half.

Something that could be easily gotten afloat was needed. The biggest of the new life rafts weighs 90 pounds, 300 with a full load of equipment. One or two men can manage to get this weight overboard. These biggest rafts carry 20 men (27, if necessary). Smaller rafts, for two, four, six, or 10 men each, can be handled with less strength, and are recommended for small sail- and motor-boats. Such pleasure boats now carry no lifesaving craft at all. Lifeboats, even the smallest, are too big.

Other sinkings studied by the British included all that occurred during World War II. A report on these was published last year. The most striking thing learned: Over three-fourths of the persons who died in the sinkings perished in the first few minutes—either when a torpedo struck, at the instant the ship went down, or while swimming in the water or clinging to wreckage.

Therefore, the life rafts are designed

so that a worn-out or injured man can get aboard, by himself, from the sea. A small canvas ladder, with a few rungs, flip-flops down into the water to help him, as the raft opens up.

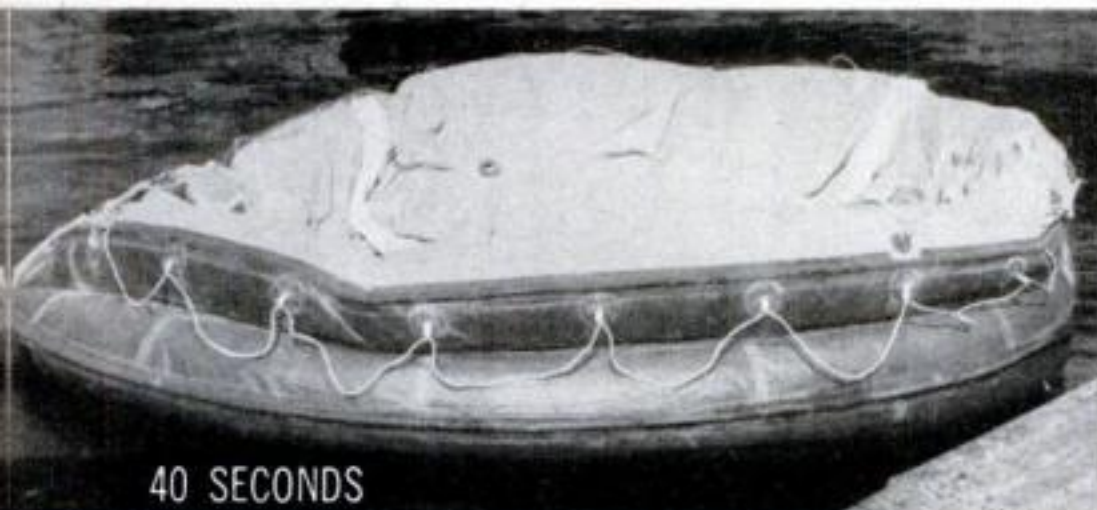
Very few persons are lost, the World War II figures showed, once they get into a lifeboat or raft. Those that die are killed mainly by exposure or by lack of drinking water.

So the new rafts carry enough cans of water for each survivor for 20 days. (This accounts for most of a fully equipped raft's weight.) On some of the rafts, there is an additional source of water. This is a solar still, towed aloft, in a balloon. The sun vaporizes sea water in the still; the salt is deposited; and the water becomes drinkable.

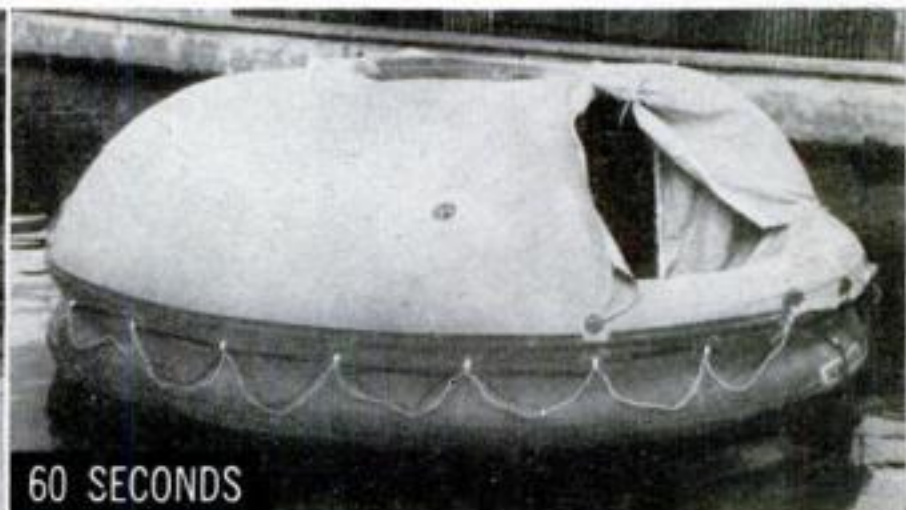
Other British surveys showed that drifting men are usually spotted long before 20 days pass. To speed up rescue, however, the rafts are glowing flame-orange for visibility. A push-button radio set can provide directional signals to bring help to the raft. And a sectional radar target can be erected to reflect radar waves to a searching vessel and thus bring it to the raft.

TO PROTECT against exposure, the rafts have double-skin tent-cover tops, which insulate against cold wind or hot sun, and keep off the rain, spray, and waves. The tops, on some rafts, are supported by inflated arched thwarts. The rafts have double bottoms, which insulate against the cold sea. Tests in the open Atlantic, under Arctic conditions, showed that the body heat of a

[\[Continued on page 222\]](#)



40 SECONDS



60 SECONDS

At this point men can leap upon it . . . Last thing, the top pops up and makes the raft snug.

"It's all part of George



Macabee's plan to get me fired," Tommy cried.

Gus Rescues a Rival Mechanic

By Martin Bunn

WHEN Tommy Brown came into the Model Garage, Gus Wilson noted that his normally pleasant expression was missing.

"Mr. Wilson," he said, "I've half a mind to punch George Macabee in the nose."

Gus could hardly keep from smiling. This thin-shouldered lad of 18 threatening to wallop burly George Macabee?

"Now why would you want to do that, Tommy?" Gus asked.

"For some reason," Tommy said, "George Macabee is trying to get me fired from my job at the creamery. You know I got promoted from maintenance helper for Mike Pagett on the day shift, to light repair of the creamery's rolling stock at night. Every evening drivers list on a complaint sheet what's wrong with their cars and trucks. I fix them during the night. I was doing all right until George Macabee started putting down the same squawk every night about his salesman's car. There's nothing wrong with it."

"That doesn't sound like a thing that George Macabee would do, Tommy," Gus said reflectively.

GUS had a strong hunch that things were not as Tommy thought. But to scoff at his convictions might turn the youngster away from adult influence when he needed it most. Tommy's father was dead, and he often came to Gus for advice.

Gus put a hand on Tommy's shoulder. "Sounds like a pretty low trick," he said. "What does he claim is wrong with his car?"

"Nothing serious," Tommy said. "He's too smart for that. If it was serious, the car would be laid up and sent into the day-shift garage for major repairs, since I'm only supposed to handle minor ones. He just claims it backfires, loses power and misses every now and then. I've checked it all over and there's nothing wrong with it. If Macabee keeps complaining, first thing you know I'll get fired."

Gus asked, "Then why not get Pagett to send the car to the garage so your regular mechanics can look it over?"

"That's just what Macabee wants," Tommy cried. "It's all part of his plan to get me fired! The mechanics wouldn't find anything wrong. But after they finished tinkering, Macabee would claim that it ran all right and that they'd fixed something I'd overlooked. I'd be in Dutch for sure."

"I see," Gus said. "Well, if George Macabee thinks he can get away with anything like this, he's mistaken. Late tonight I'll come down to the creamery and we'll go over that car together, Tommy. Then if Macabee tries to keep up this farce, we'll call him."

Tommy's eyes sparkled. "I knew you could do something about



"You know, George," Gus said thoughtfully, "I don't think I should fix it at all."

it. Boy, will Macabee back off when you ask him what he's trying to pull! We'll teach him a lesson."

"Maybe so, Tommy," Gus said soberly. "And lessons never hurt anyone."

ACTUALLY, knowing George Macabee well, Gus was sure that he wouldn't engage in the tactics Tommy suggested. During the day, Gus managed to reach the creamery salesman by telephone.

"George," he said over the line, careful not to violate Tommy's confidence, "I've heard a rumor—about something wrong with your car that has Tommy, down at the creamery, worried a bit. I wouldn't want the kid to think that I was nosing into his business, but could you drop around and let me take a look at the car?"

"Sure thing, Gus," Macabee said. "To tell you the truth, I was starting to worry about getting the kid in bad."

When Macabee drove into the Model Garage that afternoon, Gus found, as Tommy had said, that the car was purring nicely. Still, somewhere, Gus was sure, was some kind of off-on trouble that Tommy must have overlooked. But after an hour's work on the car and a test drive, Gus found nothing. All he could hang on to was his conviction that Macabee wasn't just out to get Tommy fired.

This car was sweet. Its compression was on the nose, which meant sound rings and valves. Ignition points were new, perfectly gapped and aligned. The spark was fat and perfectly timed, coil and

condenser meeting all tests. The carburetor was clean, float level right. There were no blown gaskets; no loose or corroded wiring connections; no oil-soaked, frayed or broken wires or battery cables. A voltmeter showed no abnormal resistance on the line.

GUS backed to the bench at last, ran his hands through his graying hair. "And still you say that this car backfires, misses and loses power, George?" he said.

"That's right," Macabee declared. "And then suddenly it runs okay. It happens three or four times a day."

"Sounds like it's jumping out of time," Gus said thoughtfully. "Which would mean badly worn timing gears at the lower end of the distributor shaft. What gets me is that I've never seen a set of gears worn so that they could jump out of time and back again at will."

Gus decided to take a look at those gears. He pulled the distributor and its base, then the short distributor drive shaft that ran down through the engine block to the gear at the camshaft. This distributor shaft was equipped with female drive slots at each end, which received male driving wedges at the distributor and the gear. The upper female drive unit was enclosed in a round, revolving bushing that rode the engine head.

Gus stared at the bushing a moment, then peered at the head. "Here's your culprit," he told George Macabee, pointing to a small depression in the head, evidently cut by the bushing. This had permitted the shaft to drop away a bit from the distributor, just enough so the drive slot on its upper end could disengage at times from the male wedge of the distributor.

GUS proved this by reassembling the parts. He found that with a bit of finger pressure he could turn the distributor rotor all the way around. The distributor shaft had apparently been manufactured a bit too short.

"I can see why the car acts up," Macabee said. "But I can't see how it manages to jump back into time again."

Gus kept turning the rotor, and presently there was a clicking sound.

Gus grinned. "Here's your answer," he told Macabee, who leaned over Gus's shoulder as Gus spoke.

When the garageman had finished his explanation, Macabee said, "That's great, Gus. Tommy will be tickled when he learns that you found the trouble. How are you going to fix it?"

"You know, George," Gus said thoughtfully, "I don't think I should fix it at all. A kid like Tommy needs to gain confidence in himself, in his own ability to work things out."

"What do you mean?"

"Here's what you do," Gus said. "Drive this car in, just as you always do, but leave a note for Tommy saying you thought you heard a clicking noise in the distributor. Then we'll see what happens."

"Right!" said the salesman, and he drove out smiling.

"I wonder," Gus said to his helper, Stan Hicks, telling him the whole story, "if the kid will come through. I'm anxious to know his conclusions when he lifts that distributor from the head and sees that bright depression worn in the metal. Will he be able to figure out by himself what's wrong?"

GARAGE - CLOSING time came. But Gus didn't budge. Knowing that Tommy went on shift at the creamery at six o'clock and would undoubtedly tackle the Macabee car first thing, Gus found himself calculating every move the kid would make after he found Macabee's note. At eight o'clock the phone rang.

"Mr. Wilson," Tommy said, "I found the trouble in Macabee's car."

"Wonderful!" Gus exclaimed. "What was it?"

Tommy chuckled. "I figure the distributor shaft is either too short, or the bushing on the top of it that drives the distributor has been pinned to the shaft too low down. Anyway, the bushing has been riding the head and has worn a hole in the metal so that the whole works drop away from the distributor at times, disconnecting the rotor and throwing everything out of time."

"You don't say!" Gus exclaimed. "But how did it get back into time again?"

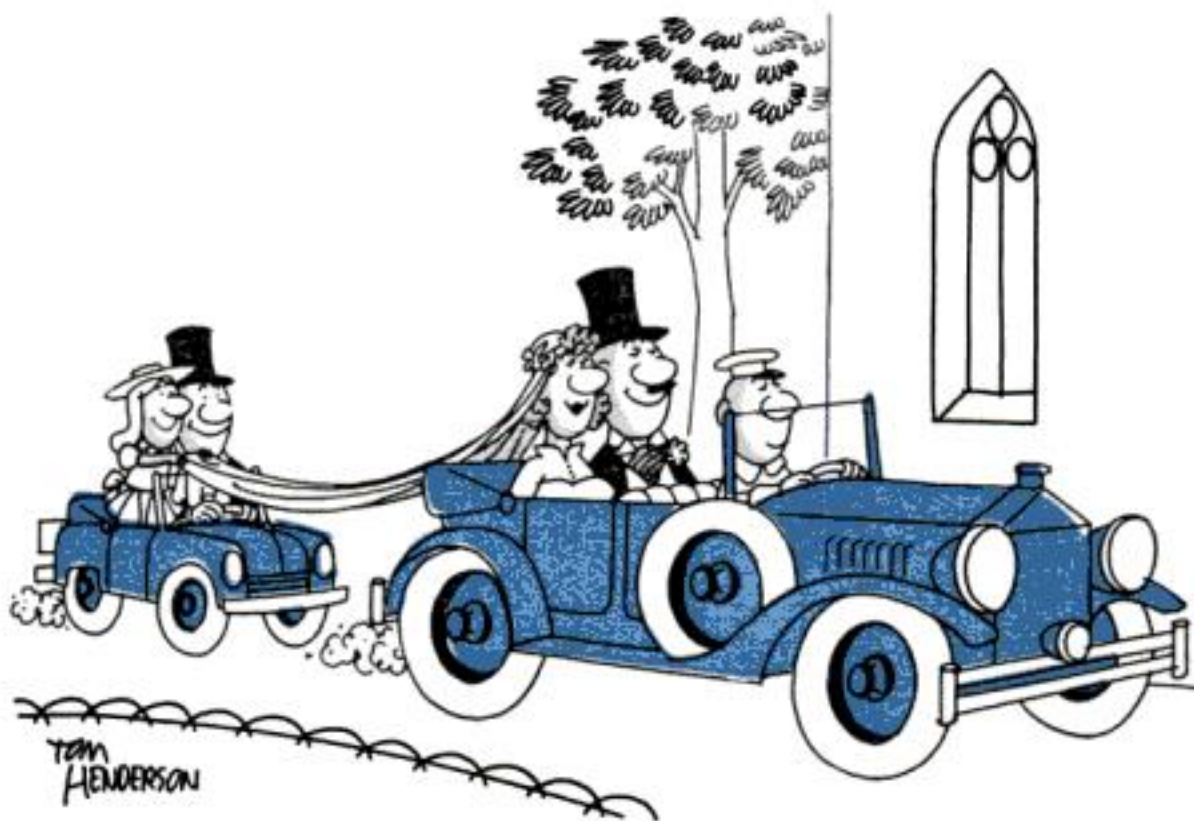
"Simple," Tommy said proudly. "When

the drive units separated, they kept turning the distributor rotor by rubbing against each other, but of course it was all out of time. Then when Macabee stepped on the gas, they'd whirl around and click back together again. Both the male and female units were cut off center, so they could only go together one way—in time."

"Smart thinking, Tommy," Gus said. "How do you plan to fix it?"

"That's got me worried," Tommy said. "I'll need a new distributor shaft and I can't get one before I go off shift."

"That pinned bushing now," Gus said thoughtfully. "Why don't you drive the



pin out of shaft and bushing and then drive the shaft down into the bushing just enough to increase the overall length a bit? Then you could weld the shaft and bushing together. That should make a permanent repair."

"Now why didn't I think of that?" Tommy groaned.

"Tricks of the trade," Gus chuckled. "You'll learn them with experience."

"I hope so," Tommy said. "Anyway, I've just learned how not to judge people."

HE CAME through all right, and then some," Gus told Stan Hicks next morning. "I thought it peculiar that the shaft had been made too short. It didn't occur to me, until Tommy mentioned that pinning, that the shaft was long enough. It was just that the bushing had been pinned on too low. That kid is going to make a real mechanic some day." **END**

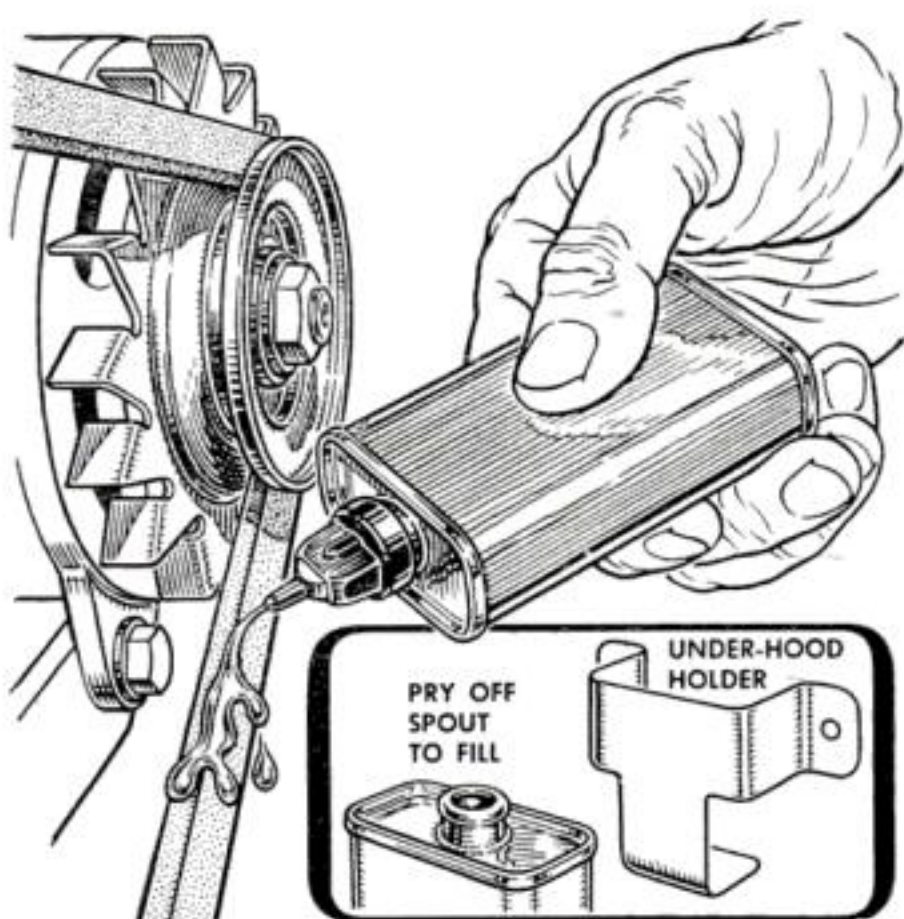
NEXT MONTH: Gus bets on a sure thing



Hints from the Model Garage



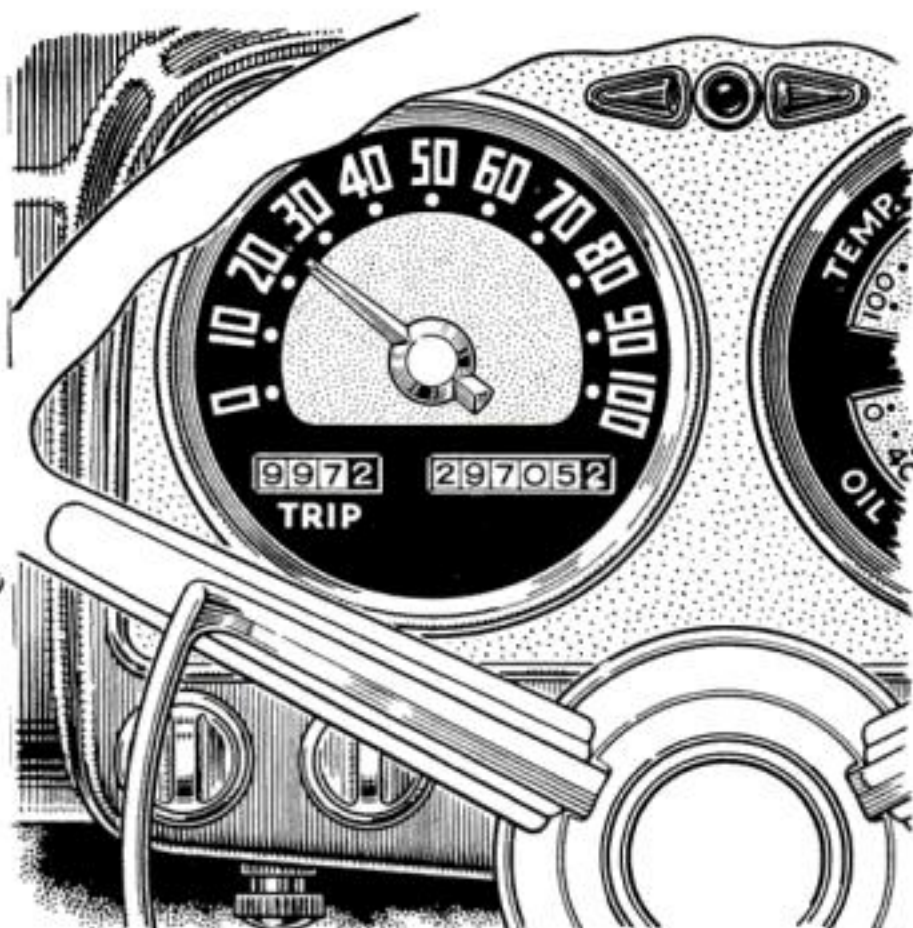
Drop a spare set of car keys in the windshield-washer reservoir bag. They won't interfere with its operation. The opaque bag makes a safe hiding place and the keys won't vibrate loose as they might if taped to some part of the car.



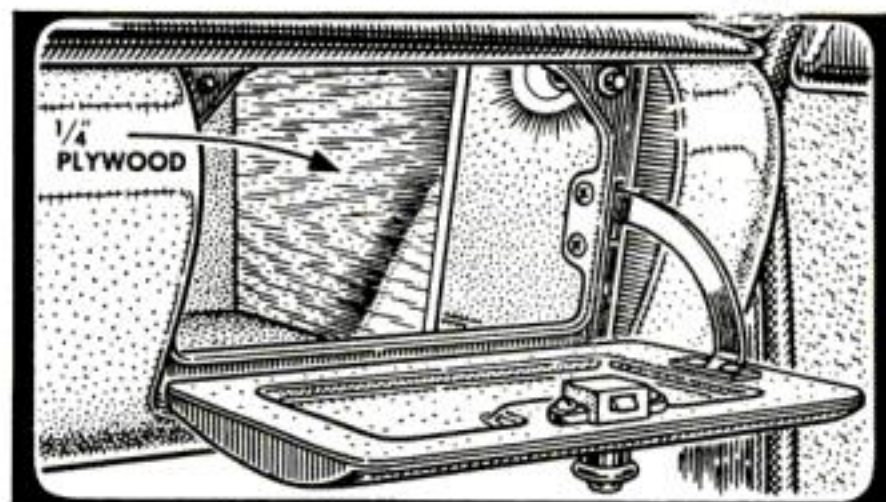
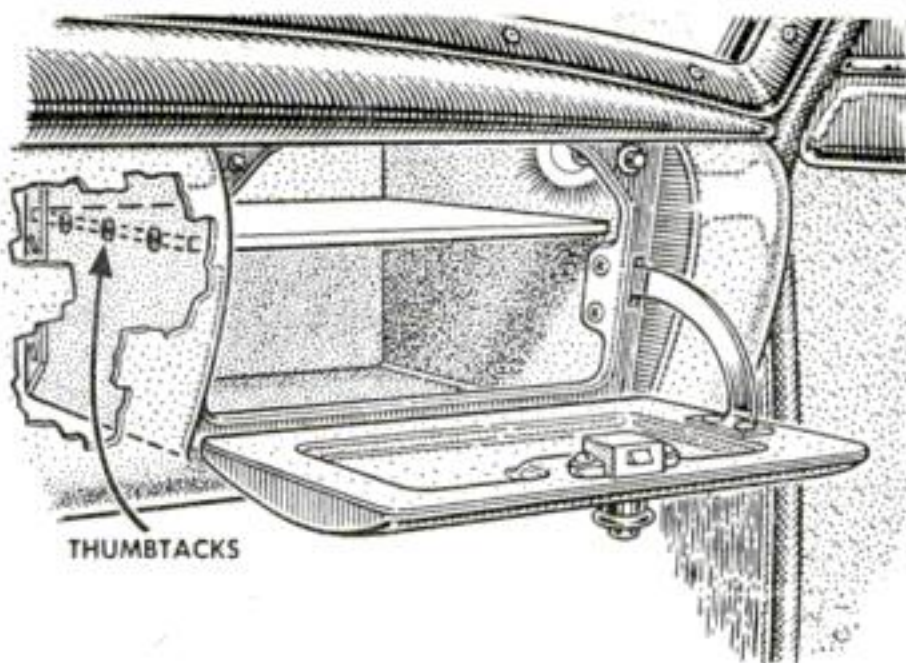
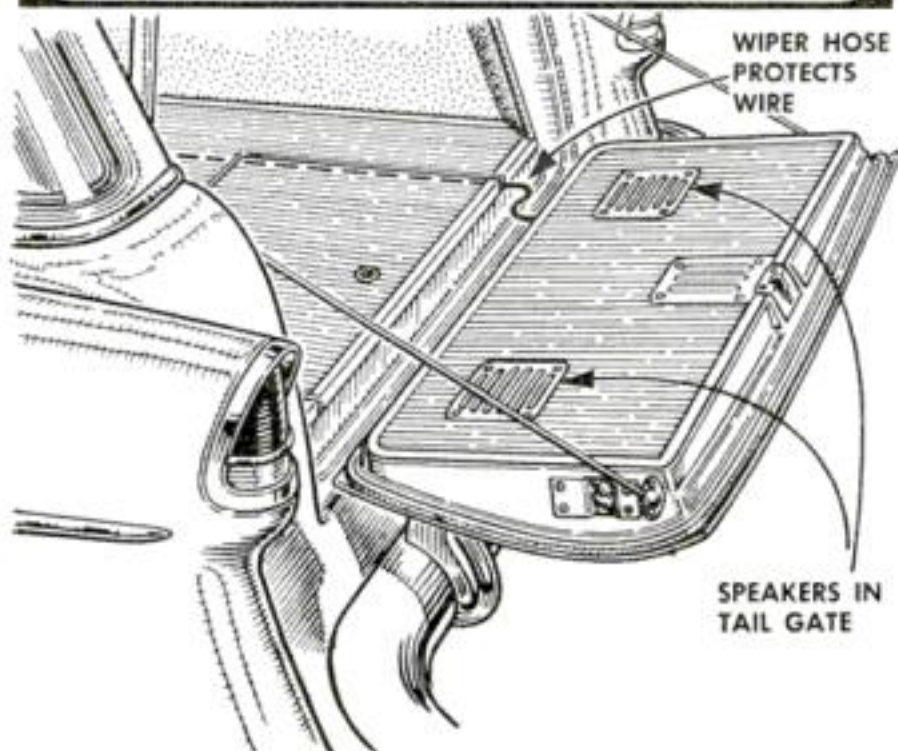
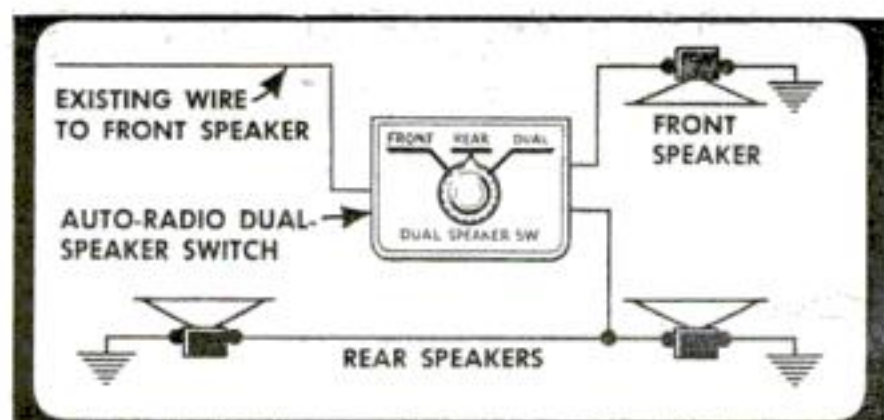
To silence fan-belt squeaks and the like, keep some brake fluid in a lighter-fuel can. It'll also lube tires for easy mounting; and give a fast cleaner for floor mats and soiled hands. A spring clip mounted under the hood will carry it.



Freshen the faded interior of an older car by spraying it with fabric dye dissolved in hot water. Use a deeper shade of the original color and saturate the material. Masking isn't necessary as the dye can be wiped off metal, glass and paint.

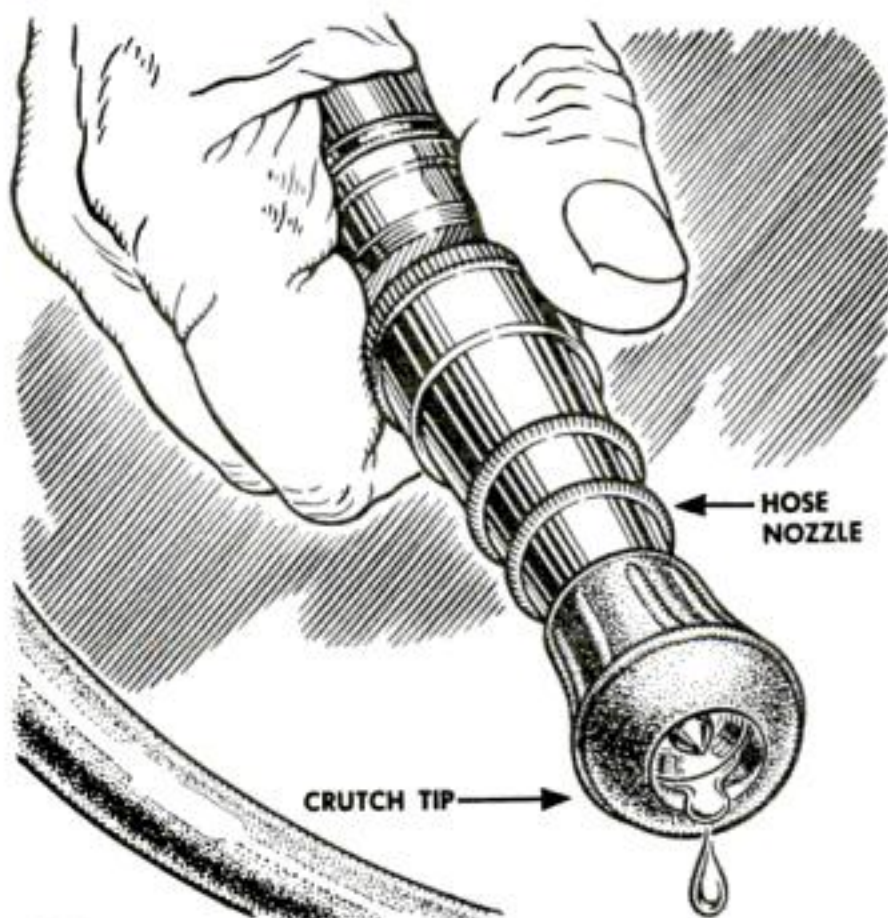


You can keep tab on oil changes if your car has a trip odometer. Set it to zero when the car is serviced. Unlike a garage sticker, which you must remember to check, the odometer will be a reminder as mileage nears oil-change time.

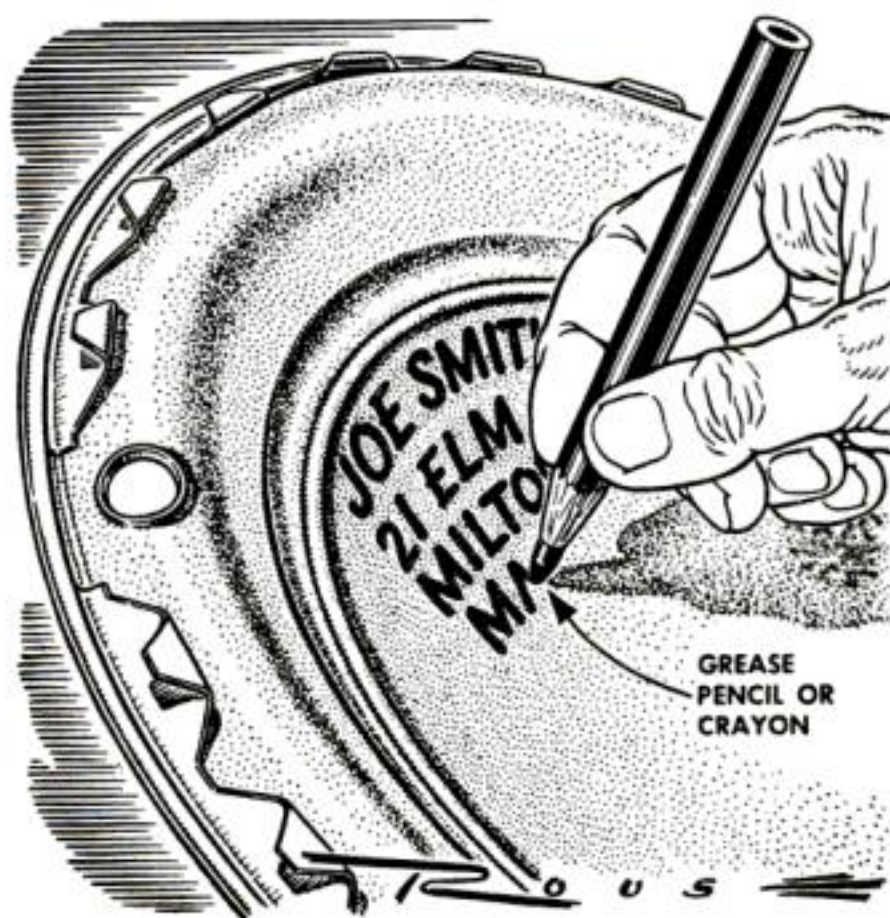


A station wagon's tailgate is a safe place to mount rear-seat speakers. Set speakers in holes cut in the tailgate and cover them with metal grilles. Connect them to the front-speaker wire with a three-way dual-speaker control switch.

A plywood shelf or vertical partition installed in the glove compartment keeps road maps neat and separate from other articles. Fasten the wood dividers with thumbtacks driven through the fiber sides or bottom of the compartment.



A hose nozzle can't scratch or chip your car's finish if you cover its end with a rubber crutch tip. Cut a $\frac{5}{8}$ " hole in the crutch tip to let the water through. Center this hole so that it won't interfere with the fine-spray adjustment.



Print your name, address and phone number with a grease pencil on the inside of your car's hub caps. If you should happen to lose one, there is a good chance it will be returned or that you will receive a call to come and get it.

**What turnpike trouble shooters
can tell you about—**

Getting Your Car in Shape for a Trip

By George H. Waltz Jr.

EACH month this summer will see some 40,000 perspiring car owners and their families stranded along our major turnpikes and thruways, while the rest of the vacation-bound world whizzes by. What's saddest about their plight is that most super-road car troubles can be avoided.

What are the most common causes of automobile failures on the pikes? How can you prevent them? And what should you do if, in spite of precautions, you find yourself among the stranded 40,000?

To find the answers I talked to some of the men most likely to know. I've interviewed drivers of service cars and tow-truck operators on the New York Thruway and the New Jersey Turnpike.

Each man I've talked with, and each record of service calls I've checked, points up the fact that just three items account for more than half of the high-speed traveler's summer headaches. Here they are: Empty gas tanks, tire troubles and overheated engines.

Last year, on the New Jersey Turnpike, the troublesome trio immobilized 25,549 of a total of 48,029 cars that needed help. Actual mechanical troubles totaled only 16,432. And even these boiled down to a few specifics that could have been avoided if the driver had done some pre-trip planning.

There were surprises hidden in the statistics, too. One is the fact that carelessness about lubrication can set a car

on fire. Another is that a bad fuel pump can burn out a main bearing.

Out of gas. In these days, when even the super roads have service areas every 20 or 30 miles, it's hard to understand how anyone can run out of fuel. Yet on the New Jersey Turnpike alone, more than 10,000 cars sputter to gasless stops each year. Surprisingly, faulty gauges account for very few empty tanks. According to service-car drivers, it's simply that motorists fail to look at their instrument panels. They also fail to realize two important things about super-road driving. One is that the miles click off faster than they do in average driving; the other, that their engines are greedier at high speeds. It's elapsed mileage, not elapsed time, that makes the gas needle dip toward empty.

Tire troubles. Chunks of chewed-up rubber along the multiple lanes bear silent witness to the toll roads' added toll on tires. Flats and blowouts account for 25 percent of all summer troubles on the pikes. Blame it on the intense heat generated at high speeds on the sun-scorched paving. Under such punishment a neglected flaw, a balding tire, or a faulty retread can let you down—fast.

Good tires are a "must" for this kind of driving. So are careful tire-pressure checks, made before you get rolling. You may hear some talk about lowering the "cold" pressure a bit to compensate for air expansion as temperatures build up inside the tires. *Don't do it.* You have more to fear from sidewall flexing with



Failure to keep an eye on the fuel gauge accounts for one-fourth of superhighway troubles.

underinflated tires than from the slight amount of overinflation caused by heat expansion. Riding quality isn't a factor here; a few extra pounds won't cause discomfort on the super roads.

Engine overheating. Six percent of all turnpike breakdowns are caused by overheated engines. A car with any of the common cooling-system ailments may get by for months of routine driving. But try to join the swim of summer traffic on a super road and you'll risk ending up in a cloud of steam. Drivers who start their turnpike trips with clean cooling systems fitted with healthy hoses, tight connections and good fan belts, will save themselves plenty of grief. Pay particular attention to your fan belt. This one-dollar

item is the culprit in 50 percent of the breakdowns caused by overheating. Even a belt that has only a slightly frayed edge can be chewed to bits in a couple of hours of high-speed driving.

Mechanical breakdowns. Of the remaining 45 percent of turnpike troubles, 29 percent are mechanical. Although they range from pitted breaker points to transmission failures, the two that top the "serious" list are burned-out connecting-rod bearings and front-end fires.

Here again, a bit of savvy would keep many motorists off the turnpike shoulders. Take burned-out rod bearings. One tow-car operator surprised me by saying: "You won't catch me starting off for a long haul over a road like this unless

Here's how the turnpike trouble shooters operate



1 POLICE HEADQUARTERS picks up data on a stranded motorist radioed in by patrol car.



2 NEAREST SERVICE CAR gets radio-relayed information: "Milepost 12. He's out of gas."

I've installed a brand-new fuel pump."

According to this veteran, the partial failure of an old fuel pump is almost as likely to result in burned-out rod bearings as a failure of the oil system. If you're cruising along at high speed and the pump diaphragm develops a partial leak you may not know it right away. There may not be any feeling of power loss, if the pump manages to keep the carburetor satisfied. But meanwhile the pump is shooting a spray of gasoline through its mounting hole into the engine block.

This spray not only dilutes the oil in the crankcase; it can wash the front connecting-rod bearings clean of oil. Friction does the rest. Traveling at high speed, there is very little warning in the way of bearing slap. At best you get off with a burned-out bearing. At worst, the friction heat ignites the gasoline-oil-air mix, blasting a hole through the side of the engine.

Mysterious front-end fires can usually be traced to grease-hungry front-wheel bearings. When such a bearing runs hot, it is fueled by the outside accumulation of grease, supplemented by flammable fluid if the brake line lets go. First, smoldering; then flame. If the car has an undercoating, the fire is likely to spread. Result—not only a burned-out wheel bearing, but a scorched front end. The experts urge you to repack all wheel bearings before you start on that long vacation jaunt.

"Do you know your car is on fire?"

A surprising number of fires, other than the front-end variety, go unnoticed by motorists until they pull into a service area. Many have been started by that old incendiary team—a cigarette and car upholstery. Others result from faulty fuel lines and exhaust pipes.

Typical is the case of a New York Thruway driver who wheeled his aging car up to the pumps not long ago. He was unconcerned, but the attendant immediately smelled burning fabric.

A quick check showed that the interior upholstery was okay. But the attendant's sharp eye caught a whisp of smoke curling out of a seam in the rear deck. Yanking the trunk lid open, he found a smoldering wad of rags wedged into the well that normally holds the spare tire. Hot exhaust gases, passing through holes rusted in both the exhaust pipe and the well bottom, had ignited the rags.

The driver admitted that he had been using this improvised seal to keep exhaust fumes out of the car interior. Death was riding with him and he didn't know it. For carbon monoxide isn't stopped by a porous wad of cloth.

Steering-gear and brake failures. I got much the same reaction from service-car men every time I asked about faulty steering mechanisms and brakes.

"We don't get as many calls for that sort of thing as you might expect. In most cases of defective brakes, a driver gets enough forewarning to send him into



3 HI-OCTANE COMING UP. Jersey Pike service men refuel 10,000 such casualties a year.



4 NO TIPS ALLOWED. But here's one for you. Play safe—drive on top half of your tank.

the nearest service area for repairs. And if one of our highway patrolmen spots a car with a bad shimmy or wobble, he shoos it off at the next interchange. Of course, it's a fair bet that steering and brake failures play a part in some of the accidents we tow away. Usually the front end is so messed up that you can't tell what caused it."

Vapor lock fools many motorists. Battery trouble, lack of oil, and a variety of other ailments that can't be classed as mechanical, round out the turnpike troubles. One familiar cause of conk-out has a pattern like this:

The day is a scorcher. After a hundred or so miles of fast driving, a motorist decides to take a break. He pulls off at a restaurant or snack bar, shuts off the ignition, and goes inside. Five or ten minutes later, refreshed and cool, he slides back into the driver's seat and hits the starter.

Nothing happens. He tries again. The engine won't take hold.

His first thought is ignition trouble. What he's forgotten is that summertime is not only vacation time—it's vapor-lock time. His hot engine, grown even hotter with no fan to circulate cooling air while the car has been parked, has vaporized the gasoline in the fuel line. Gas bubbles are blocking the flow of fuel to the carburetor.

Help comes from the service area. This is an old story to the turnpike trouble shooter. He simply opens the hood

and pours cold water on the fuel line nearest the exhaust manifold, on the fuel pump, and on the sides of the carburetor. The next try at starting usually brings action.

This cold-water treatment is good in an emergency. But the best way to avoid future vapor lock is to check the fuel lines for such gas-bubble traps as dents and sharp bends, and then to insulate the section of fuel line nearest the exhaust manifold by wrapping it with glass fiber or asbestos tape.

Don't make a target of yourself. The one thing that both police and service men tried hardest to impress upon me was that every stalled car on a super road is a potential accident maker. If you're in trouble, don't get out of your car on the pavement. Pull off on the shoulder if you possibly can, even if it means ruining a flat tire. Once you're there, raise the hood to show that you need help. Then get back in your car and wait.

The first highway patrolman who cruises by will stop and check up on your trouble. If it's minor—gas, oil, fan belt, brake or transmission fluid, overheating, tires, etc.—he'll radio a request for a service car. If it's a mechanical breakdown, he'll put in a call for a tow car. The charges will be nominal, and are listed on the service slip.

Above all, don't run the risk of adding a hospital bill by wandering around your car while you're waiting. END

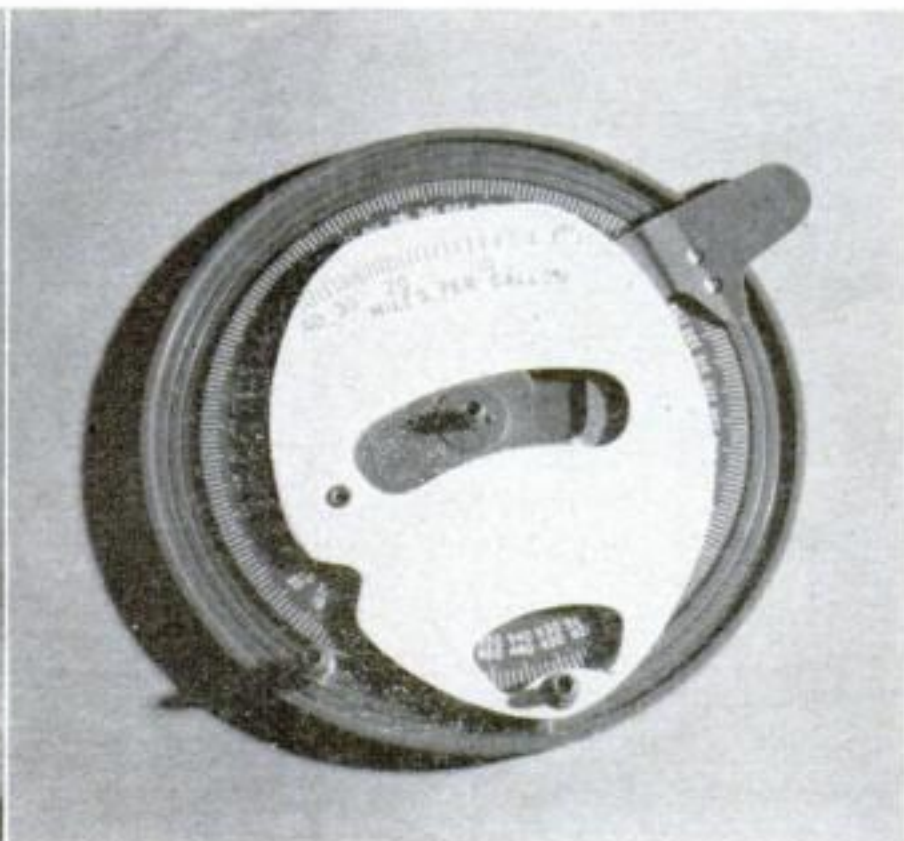
New for Your Car

.....



1. Gas Mileage Computer. Advance the handle of this little mechanical "brain" to the mileage shown on your speedometer, and it registers the miles per gallon you got out of your last tank of gas.

It does all the calculations for you: automatically subtracts the last speedometer reading from the present one, divides the number of gallons it takes to



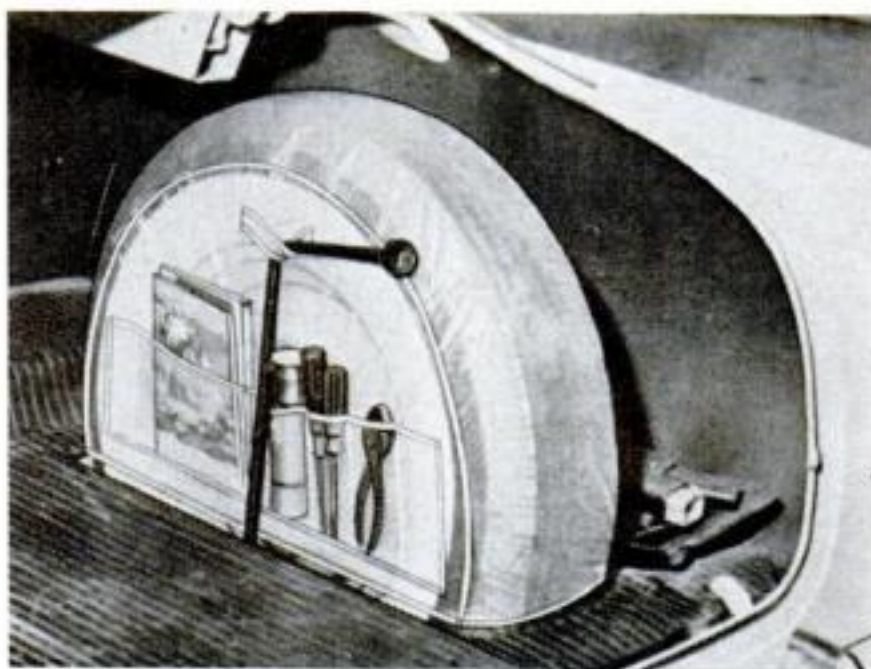
refill the tank into the mileage, and gives the result in miles per gallon.

Its action is based on logarithmic calculations worked automatically as you move the handle. A ratchet turns the mileage disk and, at the same time, a button on the white m.p.g. vernier scale (shown in the open view above) rides a mathematically designed cam.



2. Screen Fits Rear of Station Wagon.

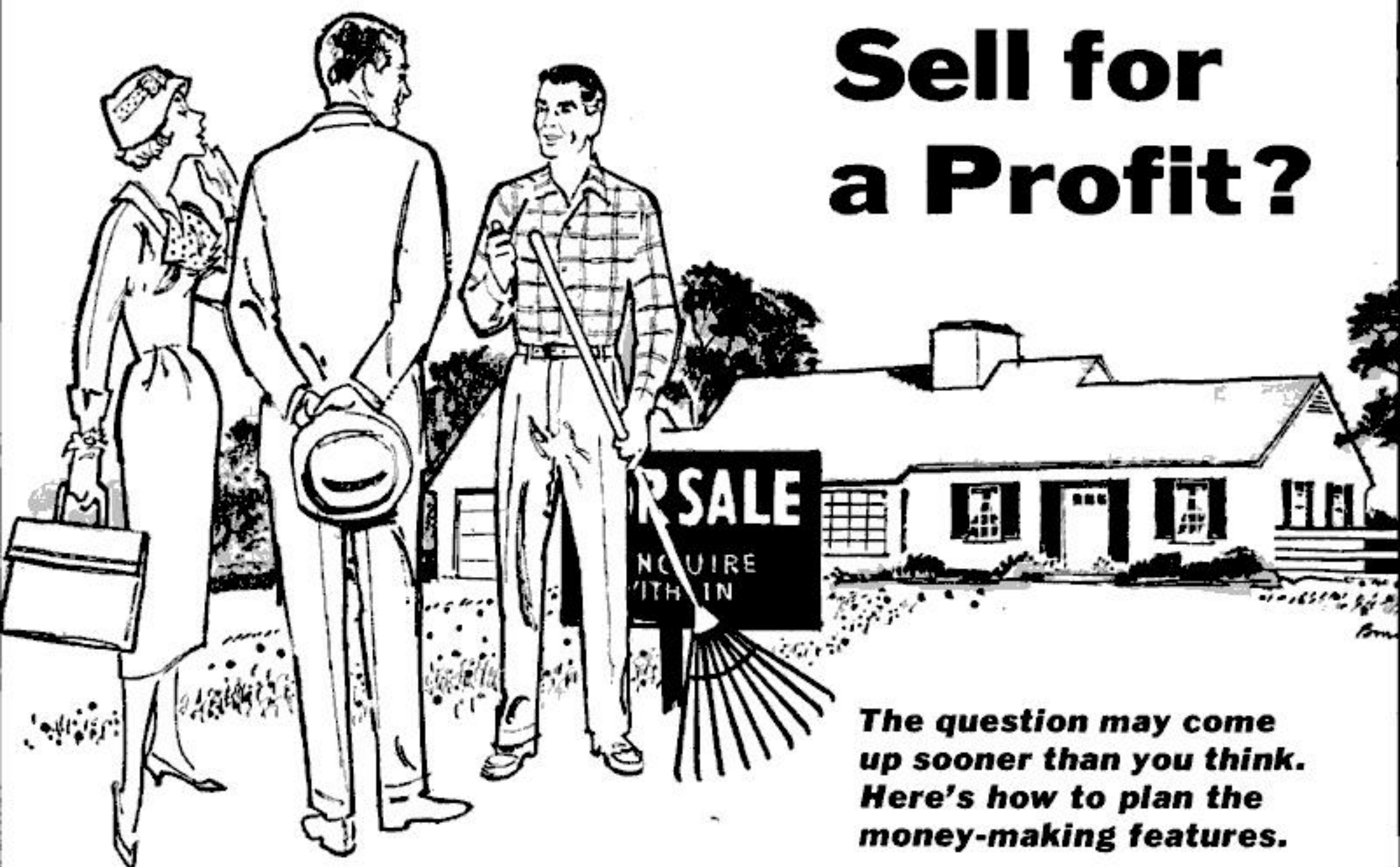
Elastic cords hold this nylon net over the tailgate and help convert a station wagon to insect-free sleeping quarters. Besides the "sleeping porch," which is available for most station-wagon models, you can get snap-in screens to go into station-wagon or sedan front windows.



3. Spare Cover Holds Tools. Pockets in this plastic tire cover make it a carry-all for tools, manuals, flashlight, work gloves and polishing cloths, and keep them from rattling around the trunk and bumping luggage. You can stand a lug wrench upright by slipping its handle through a reinforced loop near the top.

More information about these new car products can be obtained from: 1. Aerolab Supply Co., 3411 Chatham Rd., Hyattsville, Md.; 2. Bemis Bro. Bag Co., 408 Pine St., St. Louis 2, Mo.; 3. Schiller Co., 180 Wacker Dr., Chicago 6.

Would Your Home Sell for a Profit?



The question may come up sooner than you think. Here's how to plan the money-making features.

By John L. Springer

CHANCES are you'll sell your home sooner than you think. The average U.S. family lives in two or three houses in its lifetime; the average mortgage runs only seven years, in most cases because the owner moves into a new home.

When you put your house up for sale, one of your aims will be to get as much money out as you put in. You can even make a profit. Millions of Americans have—not only from the general rise in prices since they bought their homes, but on the improvements they have made while living in them.

But before you spend any money, you have to know what features a house must have and which improvements are the best investment. Here are five basic rules of house value agreed upon by real-estate brokers, appraisers and other experts. The rules apply whether you plan to buy

a house (new or old) or to fix up your present home.

1. Does it have what buyers want? Buyers expect certain features with houses in different price ranges. For example, most persons seeking a three-bedroom house now want two bathrooms. Put in a third and you may never recover its cost. But put in a second bathroom and you'll probably increase your home's value by as much or more than the cost.

Buyers of two-bedroom houses ordinarily don't expect separate dining rooms. But try to sell a \$40,000 house without one and you're in trouble.

Today, garages are expected with all but the cheapest houses. The absence of one can often hurt a house far more than the cost to build it.

The chart on page 144, based on figures compiled by the Bureau of Labor Statistics, shows the features required of houses in different price brackets.

Anybody studying these statistics can

learn a lot about home improvements that pay off. If you add a masonry fireplace to a \$10,000 house, you may not get the cost back. But a man who added a \$1,000 fireplace to his \$25,000 home increased its value more than \$1,000.

2. Keep in tune with the trends. You'll get a better price if you keep in mind what buyers will probably want when you sell—say in five years.

Experts agree that Americans want more living space. Remember the millions of two-bedroom houses built without expansion basements or attics after the war? In some sections today, they are practically given away. Buyers don't want them and banks won't mortgage them because they're too tiny now.

Families are getting larger, living standards are rising, and the "extra room" for family activities and TV-viewing is becoming a fixture. Many authorities on trends, such as architect Rudolph A. Matern of Jamaica, N.Y., believe that in five years even medium-priced homes will have three bedrooms, plus another multipurpose room, two baths, full basement, and at least an oversized, if not two-car, garage.

If you're buying or building, make sure that the house has plenty of floor space that can be used now or, as with an attic or basement, expanded into later.

Most people don't realize it, but the bigger the house, the less each square foot of living space generally costs. "If a 1,000-square-foot house costs \$12,500, a house with 2,000 square feet probably could be built for at least 20 percent less for its size, or \$20,000," says Dr. Alfred A. Ring, professor of real estate at the University of Florida. "A 700-square-foot house, on the other hand, would cost about 20 percent more, or \$10,500."

The reason: Many costs are the same whether the house is small or large. Costs of the lot, garage, driveway, fireplace, etc., don't change. Two bathrooms cost less per unit than one because they share the same water and sewage lines. Appliances cost the same, big house or small.

Therefore, if you can add extra rooms economically—as by finishing off the attic—the chances are that you will profit.

3. Restrain your whims. Many homeowners have a favorite project on which they may go overboard. That's okay—if you don't expect to make a profit.

What home buyers want

Does your present house or the one you want to buy have these features? Here is what buyers most often expect to find in houses selling in different price ranges.

VALUE OF HOUSE*	BEDROOMS	BATHS	FIREPLACE	PLASTER WALLS	GARAGE OR CAR PORT	BASEMENT	INTERIOR DECORATIVE STONWORK	AREA (SQ. FT.)
Less than \$7,000	2	1	no	no	no	no	no	Less than 800
\$7,000 to 9,999	3	1	no	no	no	no	no	800
\$10,000 to 11,999	3	1	no	no	yes	no	no	1,000
\$12,000 to 14,999	3	1	no	no	yes	no	no	1,000 or more
\$15,000 to 19,999	3	1½ or more	no	yes	yes	yes	no	1,200
\$20,000 and over	3 or more	2 or more	yes	yes	yes	yes	yes	1,500 or more

*Values are based on average U. S. selling prices and may vary somewhat by region.

A professional tile setter bought a \$15,000 house. He wrapped the bathrooms in ceramic tile, and laid the front entrance, the floor in his guest closet, and the basement floor with it. With other extras, he figured his house was now worth \$25,000.

Of course, this amount of tile greatly exceeded what most homeowners want, and the house was estimated to sell for only \$18,000. The tile man had to write off \$7,000 as the price of a whim.

Another man had a \$40,000 house built with a king-size bedroom located so that it could not be broken up easily into smaller rooms. The man had to let his house go at a \$9,000 loss.

The cost of elaborate built-ins—the kind used to house hi-fi equipment, for example—may have to be written off. Unless you find an equally avid hi-fi prospect for your house, he'll refuse to pay the extra that the built-ins cost. Your solution? Construct units you can take with you.

4. Do your own work. It's the unbeatable way to keep down costs of improvements. Since professional labor on home-improvement jobs costs from half to two-thirds of the total, you can upgrade

home values thousands of dollars at a cost, for materials only, of hundreds.

One man lives in his fifth home—a \$20,000 job, mortgage-free. He bought his first house with \$2,000 cash; improvements he added to succeeding houses represent \$18,000.

What improvements are likely to increase home value the most? Experts generally agree on the following:

- Keeping the outside neat and trim. "You can't let a house deteriorate and then paint it when the time comes to sell," says David A. Finberg, president of the Greater New York chapter of the Society of Residential Appraisers. "Keep shingles and trim in good condition, repair leaks in gutters before they do permanent damage, paint window sills to keep wood from rotting—in this way you'll keep up the value of a house and prevent conditions that might require extensive repair bills later."

- Bringing the kitchen up-to-date. "The wife spends much of her day in the kitchen," says Andrew D. Wilson, head of the mortgage department of the Dime Savings Bank. "She wants a large, light, conveniently arranged room with modern

What it costs to "over-improve"

For example, here's what you might lose on your investment if you increase the cost of a \$10,000 house in a \$10,000 neighborhood by the amounts shown in this chart.

IF YOU ADD IN OVER- IMPROVEMENTS:	TOTAL COST OF THE HOUSE WOULD BE:	BUT ACTUAL MARKET VALUE* WOULD ONLY BE:	SO YOU WOULD LOSE:	
			\$	%
\$ 500	\$10,500	\$10,500	0	0
1,000	11,000	10,800	200	20
1,500	11,500	11,125	375	25
2,000	12,000	11,400	600	30
2,500	12,500	11,625	875	35
3,000	13,000	11,800	1,200	40
4,000	14,000	12,200	1,800	45
5,000	15,000	12,500	2,500	50

*Values are based on average U. S. selling prices and may vary somewhat by region.

appliances and ample, easy-to-maintain work space." Other experts agree that a modern kitchen brings big prices.

- Making use of "expansion space." Some people can't visualize that cheerful bedrooms could be created out of a dreary attic. Homeowners with imagination often turn that space into attractive living areas—and increase the value by more than the improvement costs.

- Creating basement recreation rooms. The need for separate areas for TV-viewing has aroused new interest in basement playrooms. To make the most of your money, however, a remodeled basement should have wider windows than the standard cellar type and also direct access to the outdoors.

5. Fit your house to the neighborhood. A house that meets the general level of surrounding houses has the best chance of selling quickly at a good price. Often, by making your own improvements, you can raise a low-cost house to the value of higher-priced houses.

You're less likely to make your improvements pay off, however, if you over-buy or over-improve beyond the level of your neighborhood. "If you build an expensive house amid low-priced homes, you'll probably never get your money back," says Kenneth E. Sarles of Racine, Wis., president of the Society of Residential Appraisers. "Few people will pay \$30,000 to live in a \$10,000 area."

The table on page 145 on over-improvements, developed by J. Wilson Swan, veteran appraiser of Oklahoma City, shows how much can be lost if a house costs more than the average in a neighborhood.

One man built a \$50,000 house sideways on a 50-foot lot. It was so out of proportion to its surroundings that Mr. Sarles estimated it would bring only about \$30,000.

One New Jersey couple bought a \$14,000 house in a development of \$14,000 houses, then added mahogany paneling, a new garage, a big jalousied porch and a lavish bathroom that would make a Hollywood starlet drool. They spent \$8,000—but it remained a \$14,000 neighbor-

hood. Eventually they had to take a \$5,000 loss—a high price to learn that neighborhood values tend to seek a common level.

The right improvements, however, particularly in a whole neighborhood of fixer-uppers, really pay off. Sixty families moved into a New York colony of new \$20,000 homes in 1951. Everyone immediately began planting shrubs and trees, finishing off basements and attics, adding porches. Now you couldn't buy a house there for less than \$30,000.

If you want a house that will retain its worth and resale value, it's a good idea to consult an experienced house appraiser. For about \$35, he'll examine it carefully, uncover its hidden defects and tell its real value. His opinion—and that of a competent architect—is also worth getting if you plan to spend big money on improvements. Your bank or mortgage company will recommend an appraiser, or you can write to the Society of Residential Appraisers, 7 South Dearborn St., Chicago 3.

One couple thought they had found their dream house. "Three others are bidding for this beauty, so you'd better act fast," the salesman told them. After they moved in, neighbors told them that the house had been on sale for months. Every time a deal looked set, prospects brought experts around and then backed out. The couple saved \$35 on an appraiser, but paid \$3,000 to get rid of termites.

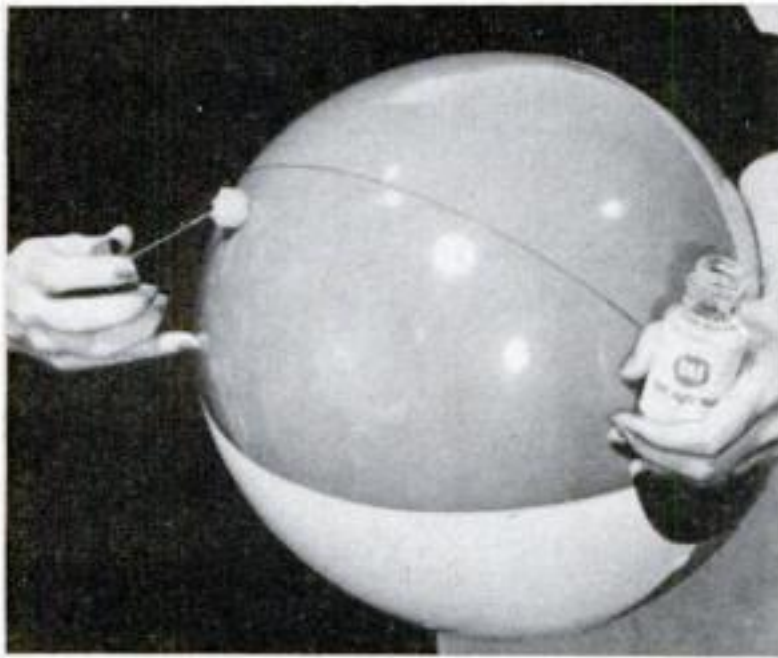
When you choose a house (or home improvements) other factors should of course be considered besides money. There's no point in denying yourself an outdoor terrace just because it may cost you more than it adds to the house value. Maybe you're a photography fan. You'll probably get enough pleasure out of a darkroom to justify the expense even if the next owner thinks an exposure meter is something the gas man reads.

But you should know whether the money you spend is actually an investment or should be regarded as paying for pleasure. Then, if you really want to get the money out of your house that you put in, you'll be able to do it. END

New for the Handyman

1. Light-Duty Sprayer.

Suction created by pressurized propellant blowing across the top of a jar of thinned paint does a quick spraying job on small projects. You can get refill cans of propellant and extra two-ounce screwcap glass jars. Besides paint, the sprayer will handle plastics, lubricants and other liquids. A blast of thinner will clean the nozzle.

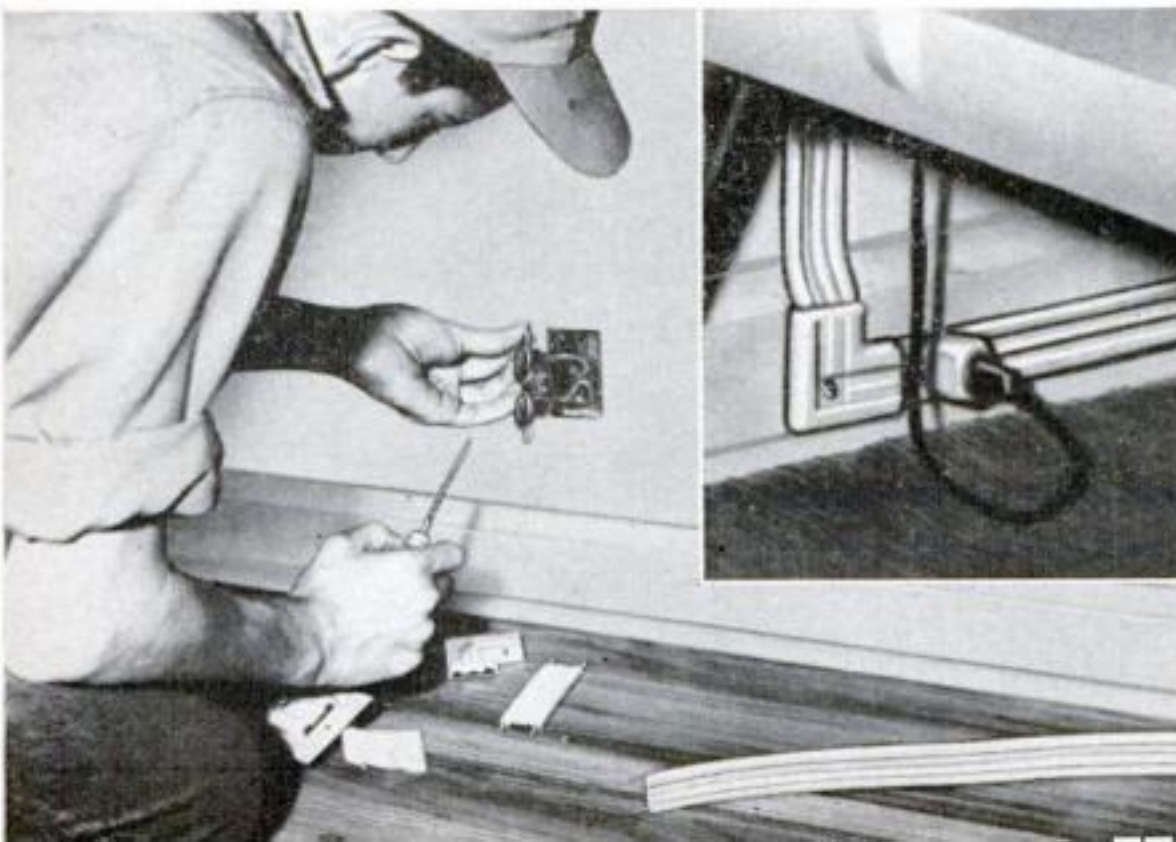
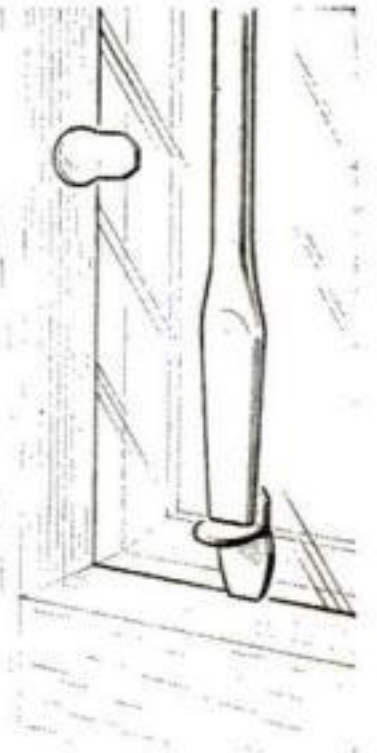


2. Liquid Mends Plastic.

A dab from a bottle of a new plastic repair fluid seals rips in inflatables, rainwear and other vinyl plastics. It dries to a tough, permanent patch.



3. Glazier's Points Have Built-In Pusher. A small, right-angle projection on one side of these glazier's points gives you a firm driving surface when you are replacing a window pane. It also acts as a stop to keep from driving the point too far into the frame.



4. Electric Strip Extends Outlet.

You can have a current outlet where you need it by installing this new bus bar on a baseboard. It is connected to an existing outlet, and one or more special receptacles are inserted at any point on its length.

More information about these new products can be obtained from: 1. H. M. Holmes, 746 N. Pickering Ave., Whittier, Calif.; 2. R. M. Hollingshead Corp., Camden 2, N.J.; 3. Atlas Tack Corp., Fairhaven, Mass.; 4. Bulldog Electric Products Co., P.O. Box 177, Detroit 32.

5 Ways

1/4" PLYWOOD
PARTITION

TAR PAPER

1" X 2"
CLEAT

1" X 8"
FORM BOARDS

SLOPED BOARD

2" X 2"
STAKE

1 WITH CONCRETE. Dig trenches as wide as curbs plus thickness of form boards. Set up forms as shown, inserting partitions at 8' intervals. If desired, slope inner form boards so curbs will cause minimum tire scuff. Coat inside of boards with old motor oil before pouring concrete. Use one part portland cement, two parts sand, four parts gravel mix. Fill alternate form sections first. When concrete has partially set, remove partitions, replace with four plies of tar paper, and pour intermediate sections. Let set 24 hours before removing the form boards.

COMMON BRICK

POURED CONCRETE

DRIVEWAY

CONCRETE BLOCK

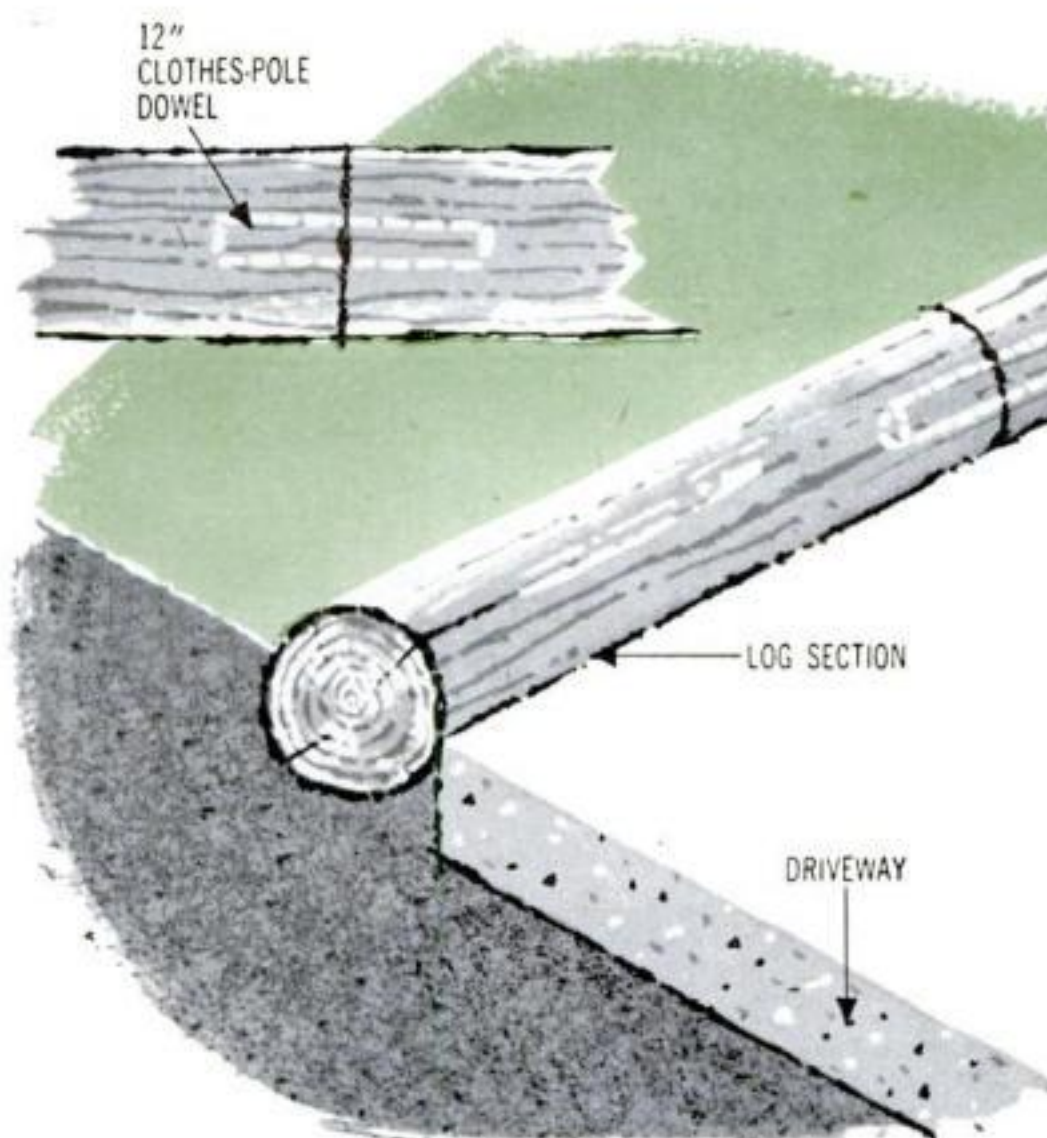
SAND

DRIVEWAY

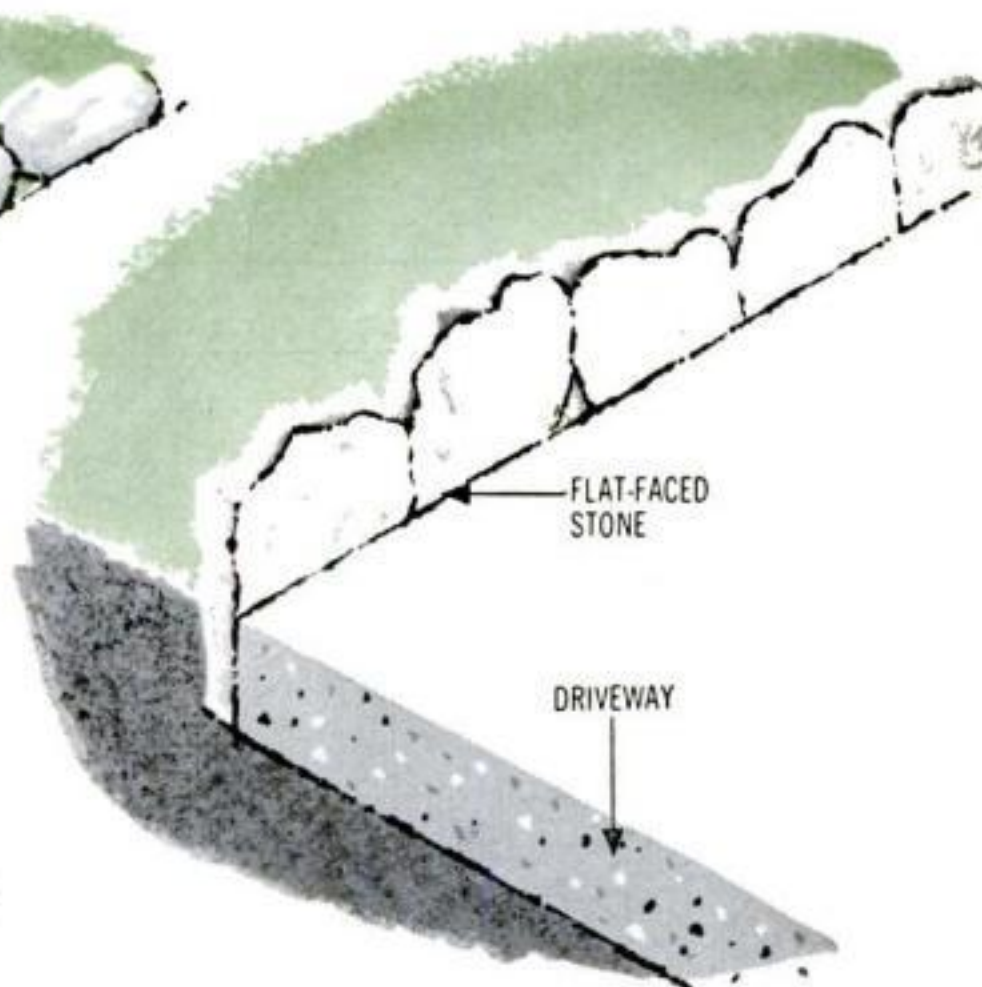
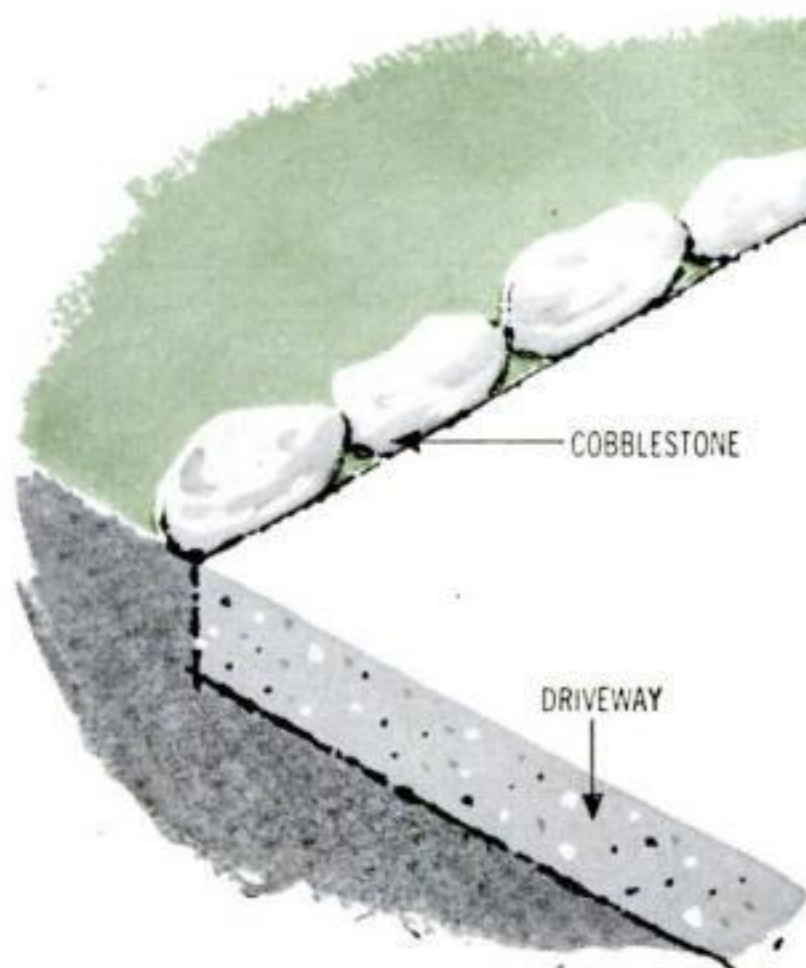
2 WITH BRICK. Set common brick, face against face, in a sawtooth pattern. Don't mortar the bricks together (frost will break the joints apart). Instead, bed the first and last bricks of each curb section in poured concrete so they will maintain an angle of 45°.

3 WITH CONCRETE BLOCKS. Dig trenches one concrete block wide and 6" deep. Spread sand to depth of 2" in each trench; then lay the blocks. Place a heavy plank above them and hammer the top surfaces level. Fill the block voids with soil, and plant flowers or ivy.

to Curb a Driveway



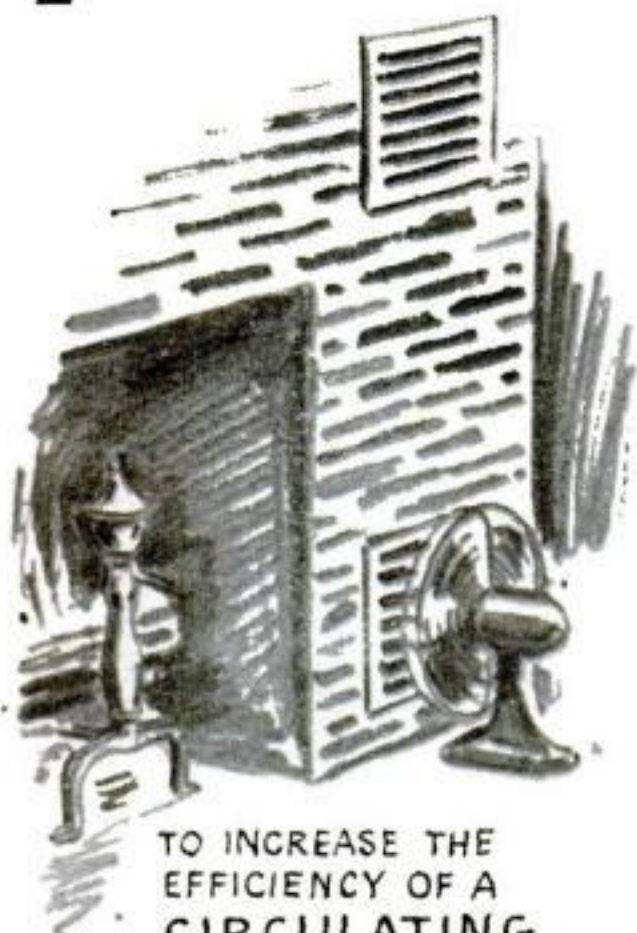
4 WITH LOGS. Use cedar, redwood, chestnut, locust or some other decay-resistant wood. Logs should be 6" or more in diameter and about 10' long. Remove bark; and either leave natural, or varnish. Lay logs in shallow trenches to prevent shifting. For permanent alignment, drill holes in log ends and insert dowel connections.



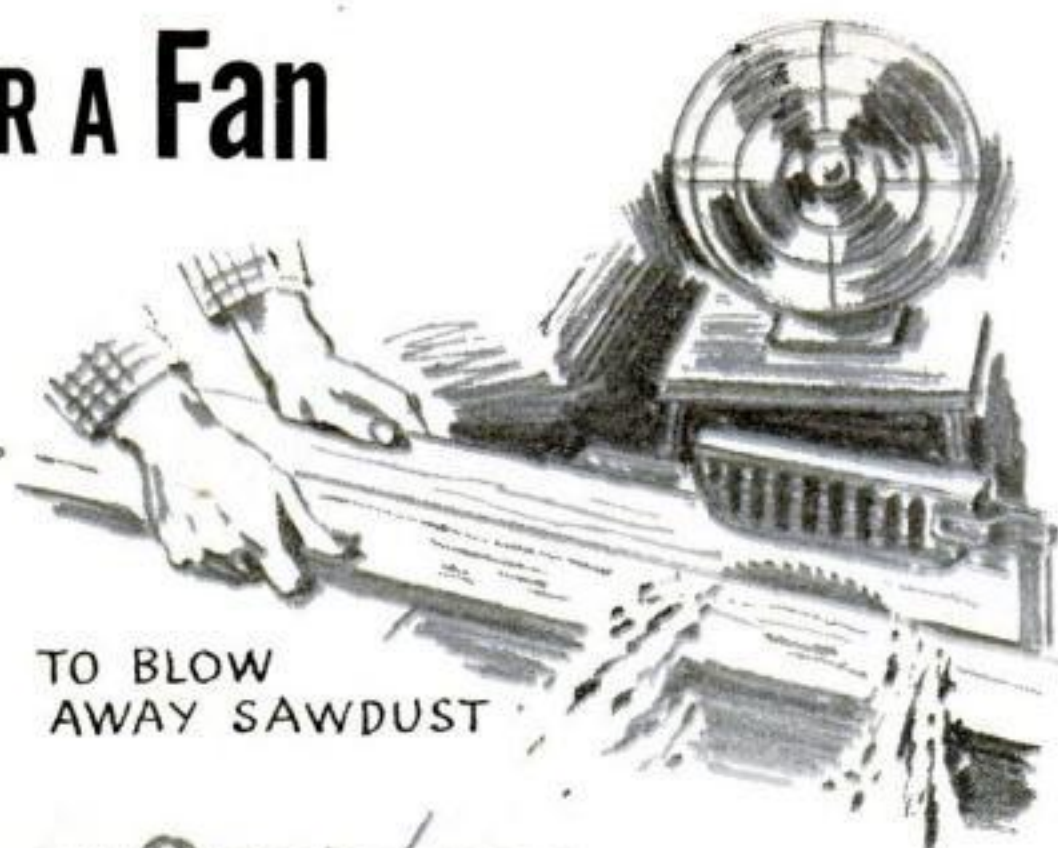
5 WITH STONES. Where a lawn is level with a driveway, field stones or cobblestones of nearly uniform size, painted white and placed at close intervals, will mark the edges at night.

White-painted shale or other flat-faced stones, set edgewise in a trench at least 8" deep, will serve the same purpose. Partially burying them lessens the chance of frost heave.

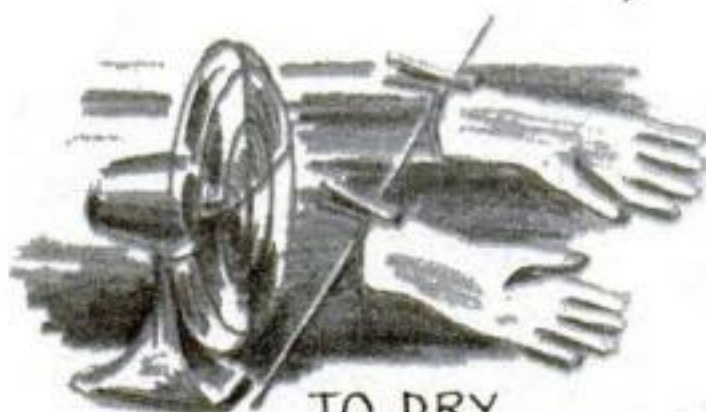
7 EXTRA USES FOR A Fan



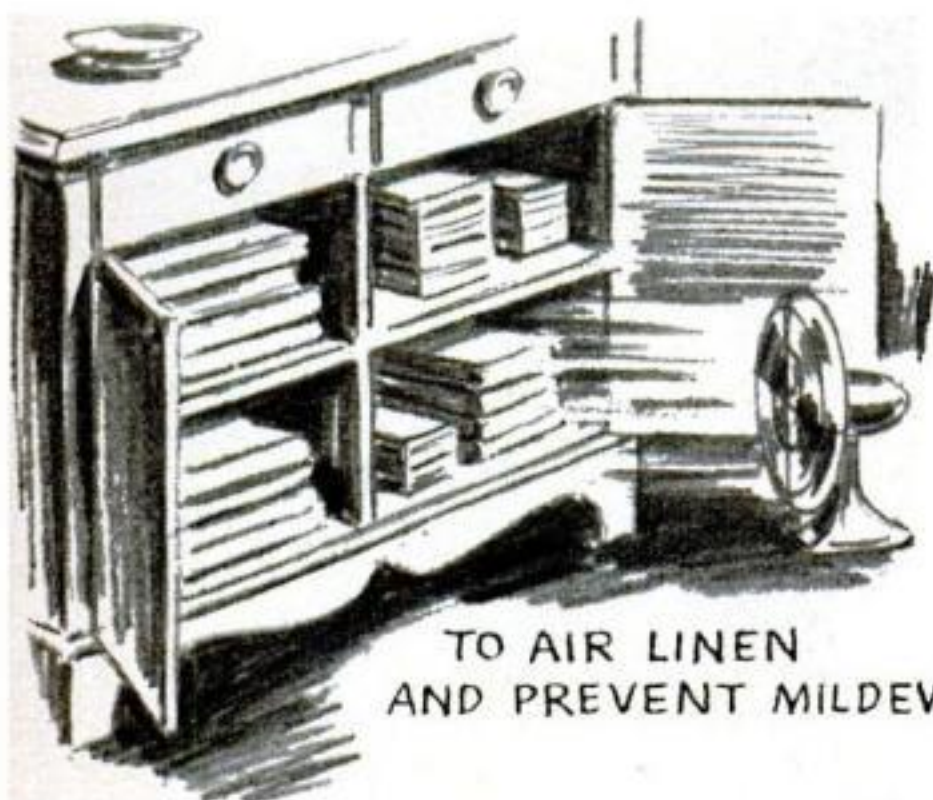
TO INCREASE THE
EFFICIENCY OF A
CIRCULATING
FIREPLACE



TO BLOW
AWAY SAWDUST



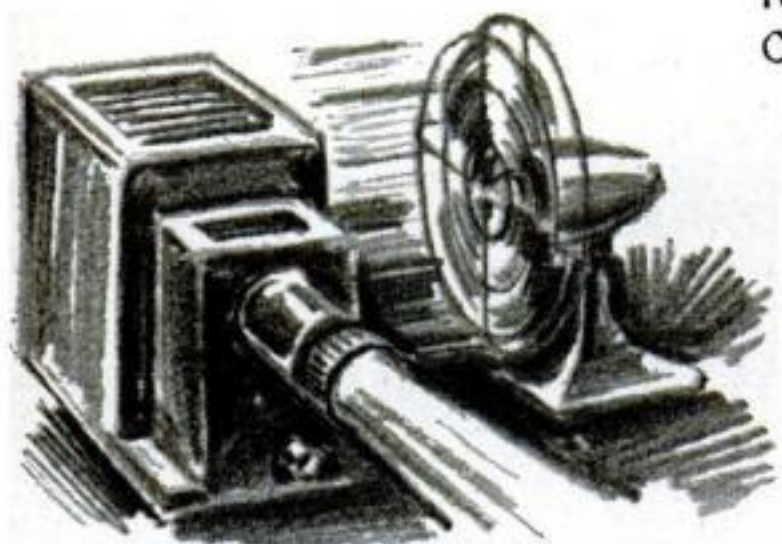
TO DRY
RUBBER GLOVES



TO AIR LINEN
AND PREVENT MILDEW



TO HASTEN
THE DRYING OF
PAINT AND VARNISH



TO COOL A PROJECTOR
IF IT HAS NO FAN



TO PEEL ONIONS WITH-
OUT SHEDDING TEARS



How I made a big discovery—

Hi-Fi Is Better Than Live Music!

By Moe Berger

UNLIKE the countless number of music lovers who first go to the concert hall and then install audio components, this enthusiast placed the cart before the horse. He set up his equipment first, about five years ago, playing a souped-up recording of an earthquake on a little 10-watt rig without a fancy pre-amp. The frightened neighbors came trooping around to see what had happened.

My equipment has come a long way since then. In the meantime I was asking myself (without doing much about it) what music at a live concert would be like. Did my high-fidelity components really re-create music with the same realism and faithfulness as the original? Would the sound of flutes, violins, drums, chimes and percussion on LP be different from the real thing? These were the questions I wanted answered.

Obviously there was only one way of answering them. So I went to a concert, my first one, a couple of weeks ago. It was a

live orchestra, with soloists, at New York City's Town Hall.

Moments before the house lights dimmed, I fearfully remembered that this would be the first time I could not adjust the damping control on the amplifier or set the equalization curve on the pre-amp. I could not switch from one speaker system to another. Nor could I make any "A" and "B" comparison tests. I couldn't do anything but listen. I was a captive audience.

Nevertheless, thoughts of sharp staccato sounds and the whirring sound that results from a turbulent rush of air out of the bell of a horn danced in my brain. I eagerly awaited the live sounds of flutes, viola, drums and oboe.

Finally the conductor raised his arms. Quick bursts of energy from the strings were heard. Next came the brasses and then again the strings. The sounds were directly ahead of me.

But wait! This was definitely not what I had expected. Where was the explosive force from the percussion? And the strings lacked presence. Even the bass notes were not bassy.

Could such things be? I felt myself itching to turn a control or relocate one of the speaker systems, but there was no control to turn or speaker system to move. This was the live performance.

If these effects were part of the realistic picture of live music, then my whole concept of high fidelity and stereophonic sound had been greatly misleading.

I had been taught to listen for the sound of a finger plucking at a string, the resin of the violin bow sucking at the strings, the boom of a bass and the burst of tympani. I surely wasn't getting any of those essential effects now.

In hi-fi and stereo, sounds seem almost to jump out at me. In the concert hall the sounds did not have this quality. But most of all, the music lacked the depth of stereo.

Stereo, they say, is an illusion. Illusion or not, it can be heard from the front, as well as from both sides, above and below. This illusion of three-dimensional sound was surprisingly lacking at the concert throughout the entire performance. The concluding applause did not stir my emotions.

I wouldn't trade my twin-triaxial speaker systems for the best seat at Carnegie. The sound of live performances is too inferior. Perhaps if the great composers, Bach, Beethoven, Brahms and the others, had a say, they too would choose sound on records. It is better sound. In addition, they would never again have to contend with coughing, whispering and restlessness. Their only complaint would be all those pops, crackles and squeaks.

Reprinted from The New York Times

Designed to be saved for easy reference, this home-repair data sheet tells what you'll need to know about repairs and maintenance of Venetian blinds the next time that job confronts you. It's part of a valuable reference series telling how to make a variety of common

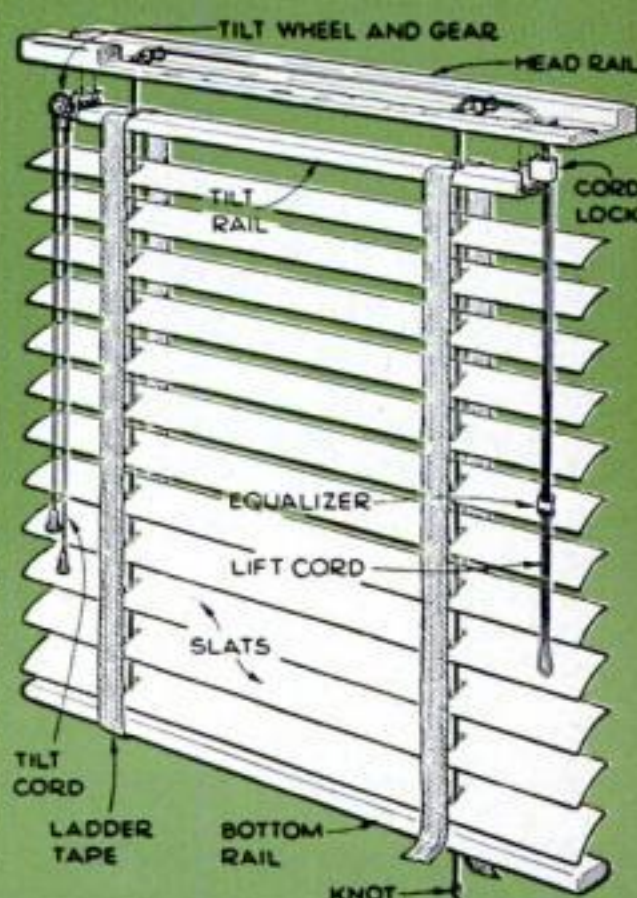
home repairs. To make your own book of home repairs, store this and the other monthly data sheets in a spring-type or ring binder. Every month's entry will add to the value of the book.

Next month: Repairing and maintaining wood-frame window screens.

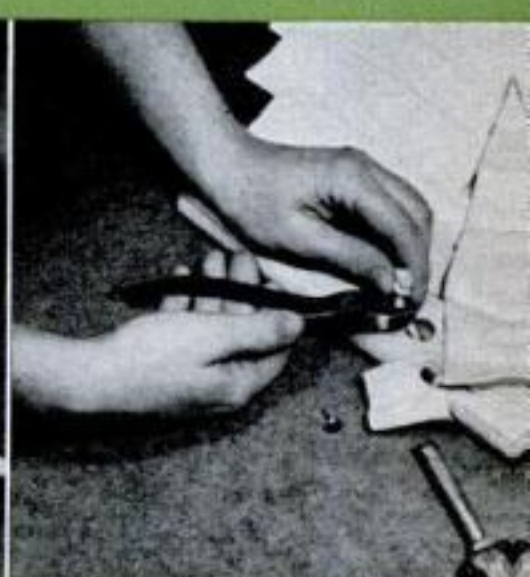
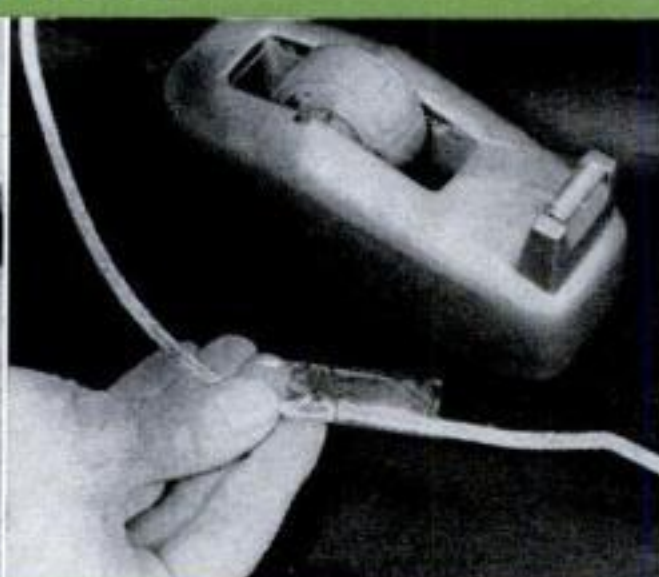
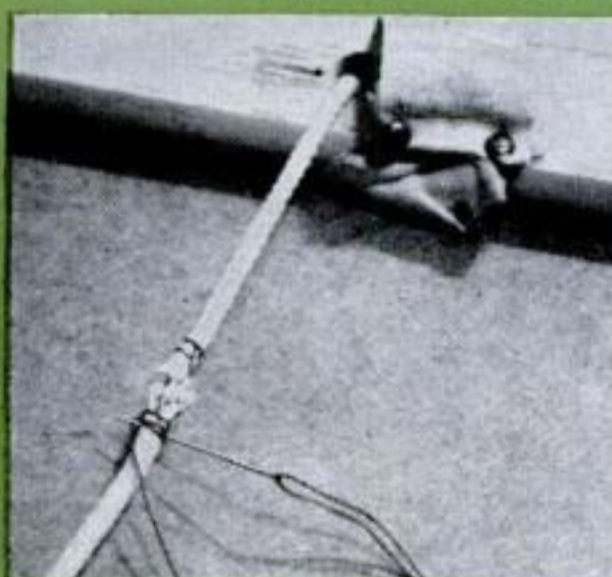
Popular Science Fix-It File



THE PARTS YOU SHOULD KNOW. All-metal blinds usually differ in two main points from the typical wood blind shown in the sketch at right. In a metal blind, bottom ends of tape and lift cord are secured by a clamp (see photo above) under the sliding cover of the bottom rail. At top, the tilting assembly and cord lock are located within the head box that substitutes for wood head rail. Wood blinds are taken down by removing fascia board (not shown), metal ones by prying out clips at front.



How to replace the lift cord

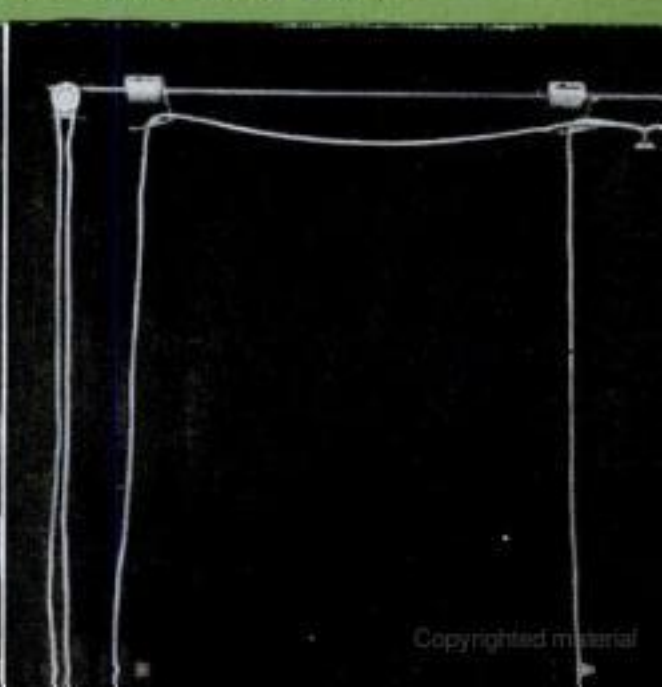


LIFT CORD is most easily replaced by splicing new cord to old (to end at bottom left of blind) with tape or thread, then pulling it through the blind. First, loosen two ends of cord at bottom rail (in wood blinds by untying knot) and slip equalizer from the lift

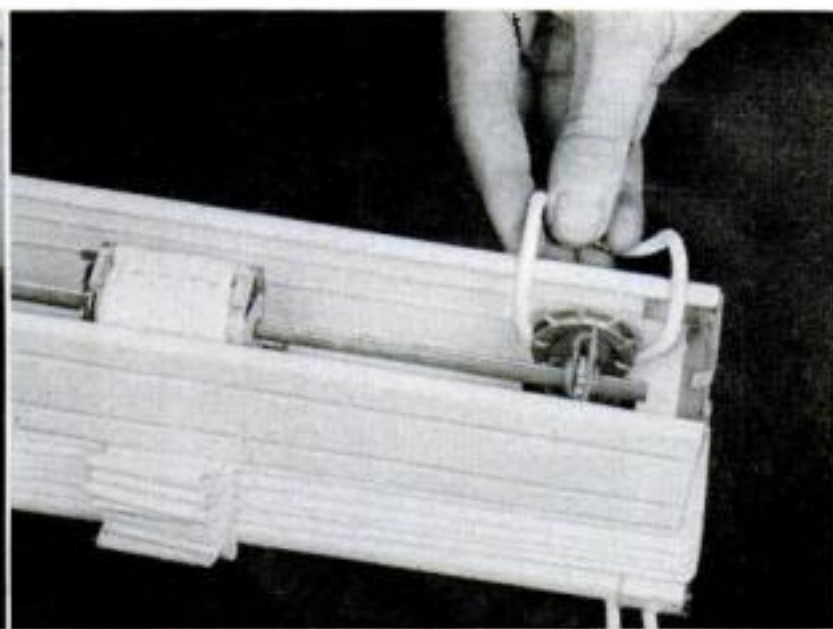
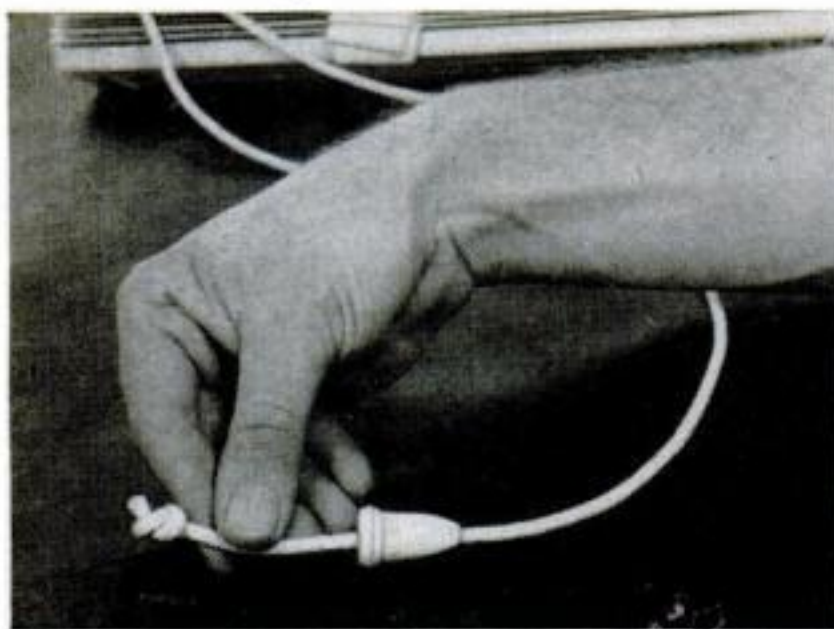
loop. To find how much new cord you need, multiply length of blind by two, add the blind width, then add six feet more for pull loop. For compound lifts (cord goes through the blind four times instead of twice), multiply the length of the blind by four.

PULL NEW CORD up through left side of blind first. Pull on one side of lift loop till last of new cord just projects from bottom rail. Then pull down on old cord at right side till new

cord appears at bottom. Secure ends of new cord to the bottom rail. If you must re-cord the blind from scratch, follow the pattern below. (These are metal-blind parts.)



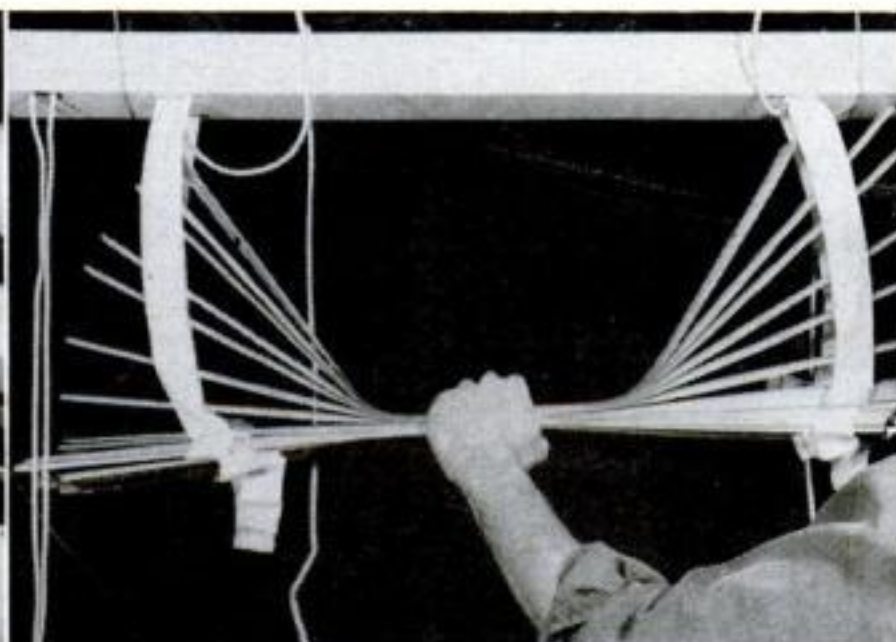
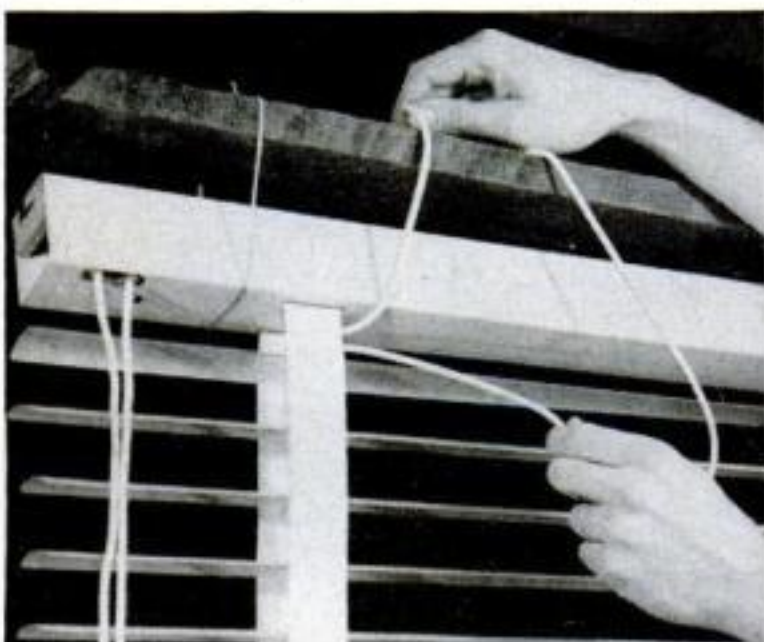
How to replace the tilt cord



SLIP CORD OFF TILT WHEEL after removing tassels by unknitting cord ends. Thread new cord over wheel and down through holes in head box (of metal blinds). Then replace tassels. Some blinds have third cord that

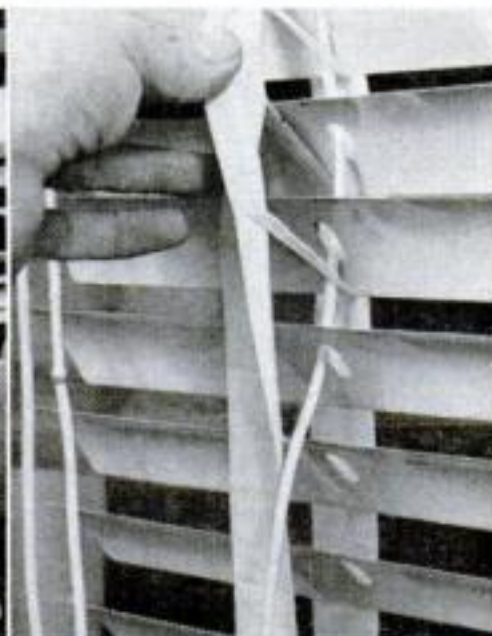
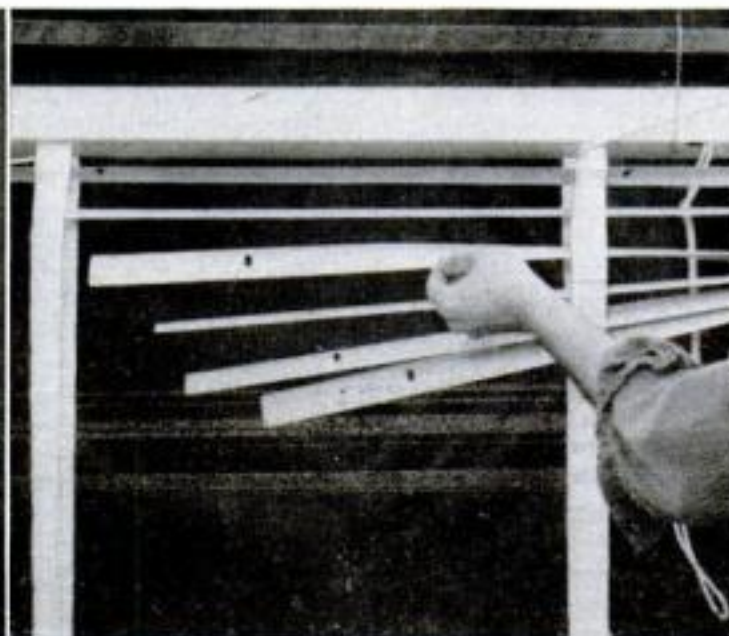
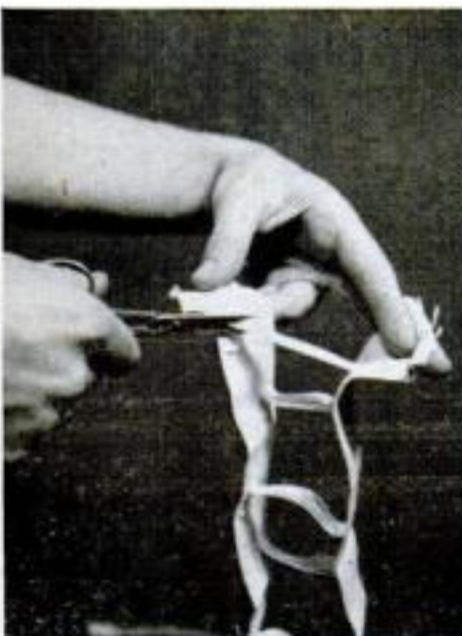
locks blind in various raised positions, the lift cord simply hoisting the blind. In most blinds, lift cord both lifts and locks blind (when you pull cord to left). A pull to the right releases the cord from its lock.

How to replace the tapes



SUSPEND BLIND to make job easier. Loosen bottom ends of the tapes and the lift cord from bottom rail. Pull lift cord up through slats (above) but don't remove from pulleys.

With metal blind, all slats can then be removed at once by gripping with one hand and pulling them down and out. Next, loosen old tapes at the top and remove them.



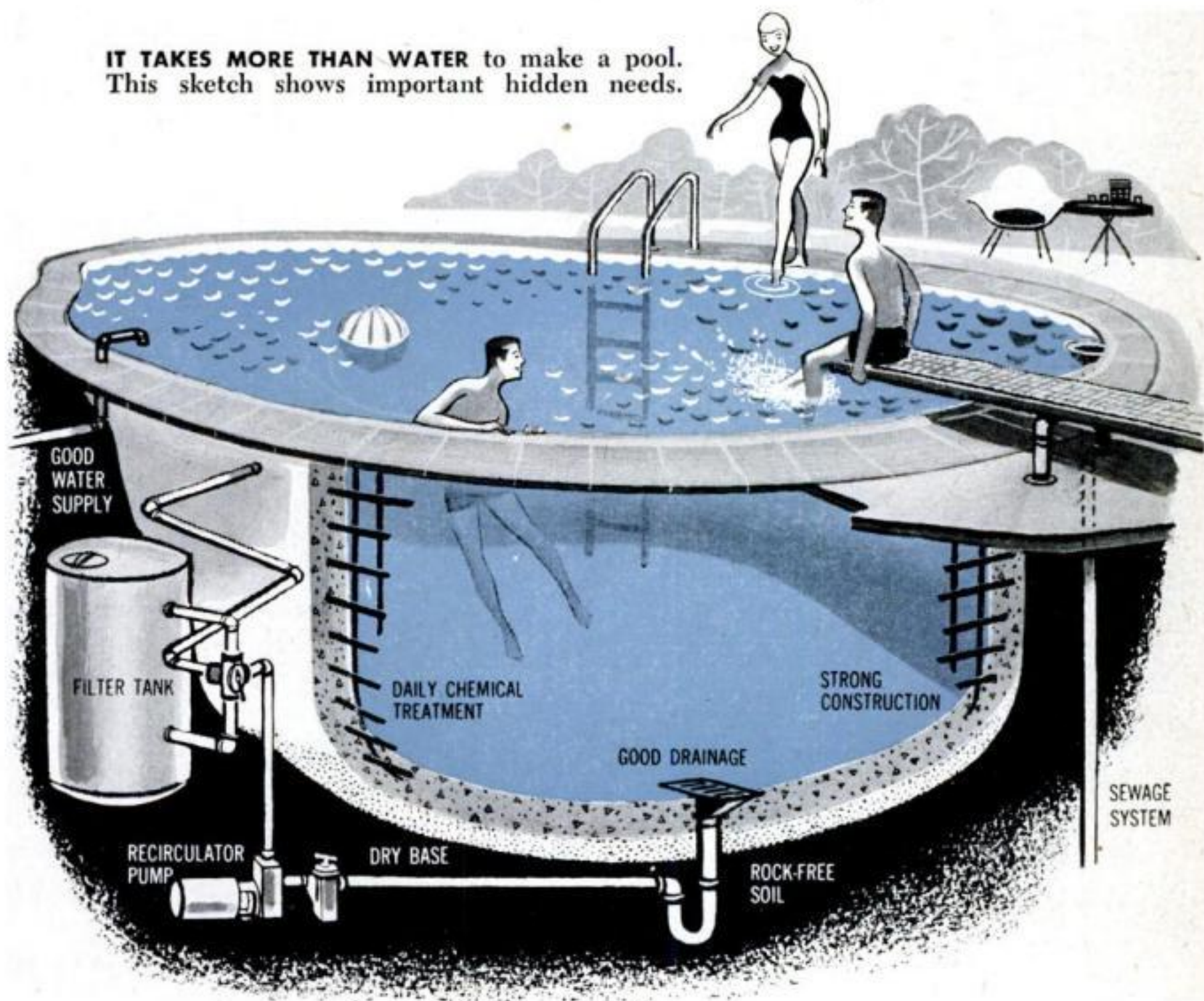
CUT NEW TAPES to match the old exactly. For this, you'll have to cut out a few of the ladders (left) that support the slats. Then attach the new tapes at the top to the drum on the tilt rail of metal blinds, or (tacked) to wood tilt rail. Shove the slats through tape and

thread the lift cord down through them, placing cord on alternate sides of ladders as shown. When it's necessary to replace a damaged slat, loosen the lock cords at the bottom and pull out just up to the height of the slat that you want to remove.

**You can have a lot of fun splashing in the back yard.
But before you take the plunge, you'd better know all—**

The Facts About Swimming Pools

IT TAKES MORE THAN WATER to make a pool.
This sketch shows important hidden needs.



By Carl Dreher

IT'S easier than ever to have a backyard swimming pool. New methods of construction, low-cost kits, filter systems and other aids are all helping to make pools more practical for more people.

Last year, Americans built more than 30,000 pools; this year business forecasters expect that they'll build around 45,000. Today there are packaged pools for \$800 that provide everything you

need, including a filter system. Portable pools come for as little as \$200.

You can even buy a private pool on time. More than a third of last year's buyers did—and are enjoying their pools while they pay for them.

Against this background, however, are serious questions of space, cost, upkeep, water supply, drainage, sanitation and safety that must be carefully considered before you take the plunge.

It may come as a surprise to know—

- That you'll need from 15 to 25



PERMANENT pools of new materials offer many shapes and sizes. All-steel Koven pool (above, left) can't crack, is made of preformed sections welded together.

Oval, glass-fiber Delorich pool (above, right) comes in four pie-like sections that are cemented together. It rests on bed of sand, can be enlarged by adding center sections like table leaves.

thousand gallons of water every time you fill an average-size home pool.

- That you'll spend more for chemicals every week than most people do on gas for the family car.

- That the cost of paint for your pool may be as much as for your house.

- That accessories such as walks, ladders, fences, pumps, skimmers, filters, vacuum cleaners and other "extras" may cost you more than the pool itself.

What type of construction? Concrete is still the most common, but today it's usually sprayed in place or used in precast slabs (both of which eliminate the cost of forms needed for poured pools). You can have a 15'-by-30' pool for about \$4,000, including a filter system.

A stiff concrete mix, called "dry pack," can also be laid without forms, but only on a shallow slope. It's less expensive, but does not permit vertical walls and is not usually as strong.

One of the cheapest newcomers is a 15'-by-30' glass-fiber pool that sells for about \$3,500 with filter. Still cheaper is asphalt, as yet not widely used but gaining in popularity. Laid on a slope, it does not permit diving from the rim, but makes possible sizable pools for \$2,000 or sometimes less.

All-steel pools are ideal in very cold

climates because they can't crack from ground frost. They require careful painting to prevent rust, however, and are more expensive than concrete.

Do you want to dive? If you take flat dives, the water depth can be 5' and you save considerable money. But if you want a springboard, the deep-end depth must be at least 8', preferably 8½'—and this for a board only 18" above the water. Higher boards require greater depths.

The diving area should slope up to a 5' depth at around 25' from the deep-end wall. This doesn't leave much room for a shallow area. To provide safe areas for both children and diving, a pool should be 36' to 40' long.

Kits and prefabs. Concrete blocks, though relatively cheap, have never been suitable for pools unless carefully reinforced because they tend to crack and leak. Now you can get a vinyl-plastic liner that combines watertightness with the economy of block construction.

The liner needs to rest only on a smooth bed of sand. You just build up concrete-block walls and fit the liner between them. You can also use an impregnated-wood frame, though these are not usually as durable as blocks.

Mail-order houses such as Sears, Roe-



PORTABLE pools like the 20'-diameter plastic model above have room for the whole family. This Hettrick pool holds 7,000 gallons, can be stored in winter, moved easily.

buck and Montgomery Ward sell complete plastic-liner kits, including a filtering system, for \$800 to \$1,300. Pool sizes range from 12' by 27' and 3' to 5' deep, to 18' by 34' and 3' to 7½' deep.

Portable, above-ground pools are also big business today—and big in size, too. You can buy a 20'-diameter pool, 3' deep, for \$200; a 25-footer, 40" deep, for \$400. The latter has a surface area of nearly 500 square feet—bigger than a conventional 15'-by-32' pool.

These consist of a plastic liner held in a circular frame. They don't permit diving and may not have the glamor of a built-in pool. But they provide a lot of swimming at little cost.

Is a pool a good investment? It is, if you keep the cost in line with your property's total worth, and if local real-estate values aren't dropping.

Most experts agree that a pool should not exceed 12-15 percent of your property's total value. For a \$15,000 house that means a pool of about \$2,000. If you spend more, you're not as likely to get back what you put in, if you have to sell.

A pool is a long-term investment. Much of its cost can be offset by "vacations at home" and less spending in other ways. But before you decide on one, you should consider your chances of moving,



YEAR-ROUND FUN is made possible by keeping pool filled in winter. This poured-concrete type, by Pools Unlimited, can be made in many different shapes.

how old your children are, and whether you'll be able to use the pool long enough to make it pay off.

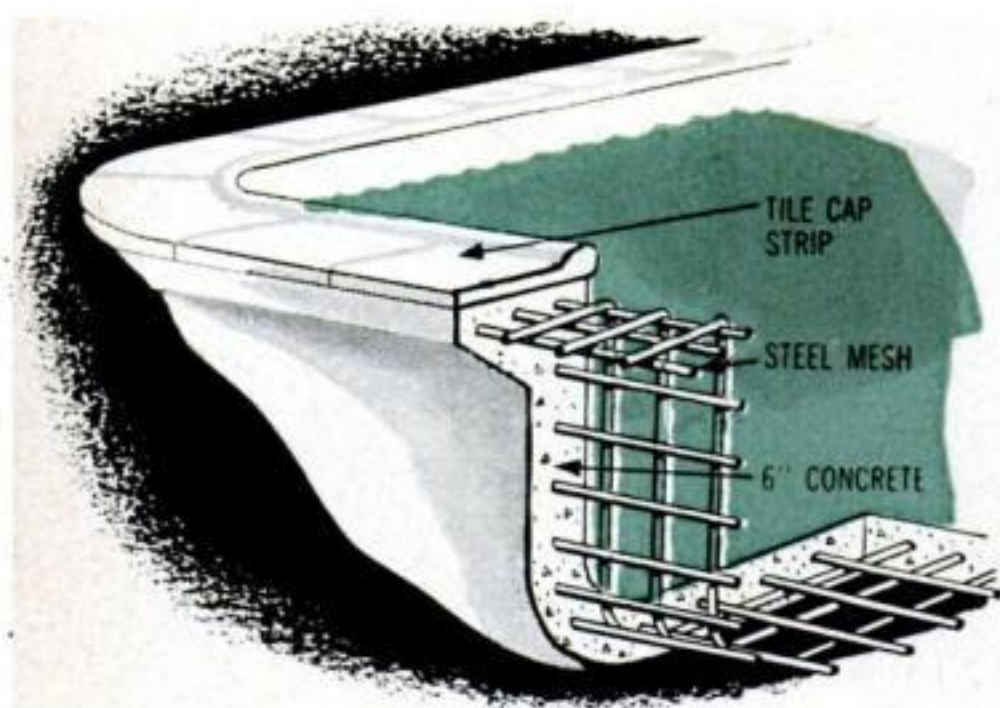
How about the law? A pool, in legal lingo, is an "attractive nuisance." This means that if anyone stumbles into it—*invited or not*—you're liable. If your present liability policy is small or doesn't cover a pool, it's wise to take out separate insurance.

You'll also need a building permit for a permanent pool. Local codes may specify construction requirements.

Where can you put a pool? Pools take considerably more space than their actual water area. A walk at least 3' wide around the edges is recommended to keep bathers from tracking dirt and grass cuttings into the water. A 20'-by-30' pool thus becomes 26' by 36'. A spring-board will require an extra 10', and a poolside play area still more.

In some areas, a pool's location may be limited by minimum property-line setbacks. If it interferes with water, gas or sewer lines, it will be costly to relocate them, or may not be possible. If you have a septic tank, a pool can't be closer than 50' to the tank or drain fields.

The best location is away from trees, which block the sun, and shed leaves and bugs into the pool. To enjoy your pool



SPRAYED CONCRETE, called Gunité, consists of mortar blown over reinforcing steel mesh. It eliminates forms, is relatively cheap, makes any shape.

in privacy, you'll also need to keep it out of sight from the street and neighbors. Hedges and fences will help, but don't forget to allow for their cost.

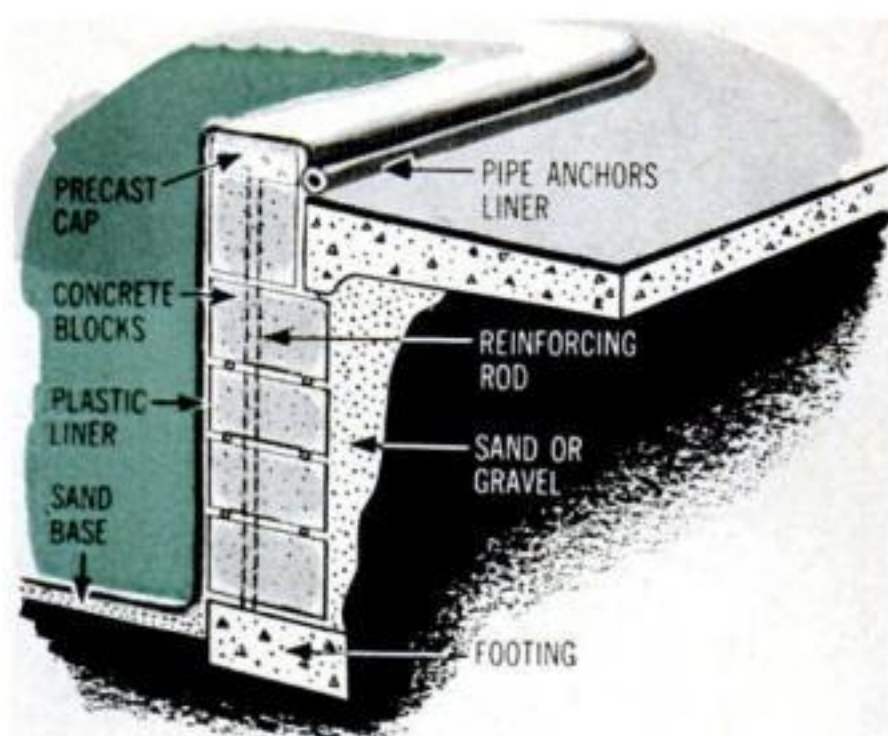
How's the ground? Pools can be built on slopes, but at greatly increased cost. Unlike a house foundation, which can be left exposed on a hillside, most pools require the support of surrounding earth. This means a tremendous amount of earth moving to tuck a pool into a slope.

Bulldozers can handle boulders, but not solid ledge rock. Before you start digging, make test borings with a post-hole digger or by driving lengths of pipe into the ground.

Removing rock will skyrocket the excavation cost. However, if the ledge is deep and flat enough, you can sometimes use it as the pool bottom itself or float a bed layer of concrete upon it. If you can get down only a few feet, another alternative is to build half of the pool below ground and the other half above.

Excessive ground water can be serious, too. Earth that's soggy much of the time indicates poor drainage or a high water table. Under severe conditions, a pool may "float," eventually breaking apart from upward water pressure.

If you suspect water or rock, get a pool expert's advice on what to do. Most contractors will not take responsibility



PLASTIC LINER adds watertight surface to otherwise weak concrete-block walls. It needs no paint, can be patched if torn, comes only in rectangular shapes.

for what may be encountered underground. Make sure, too, that you have at least an 8'-wide access to your pool location so that a bulldozer can get to it.

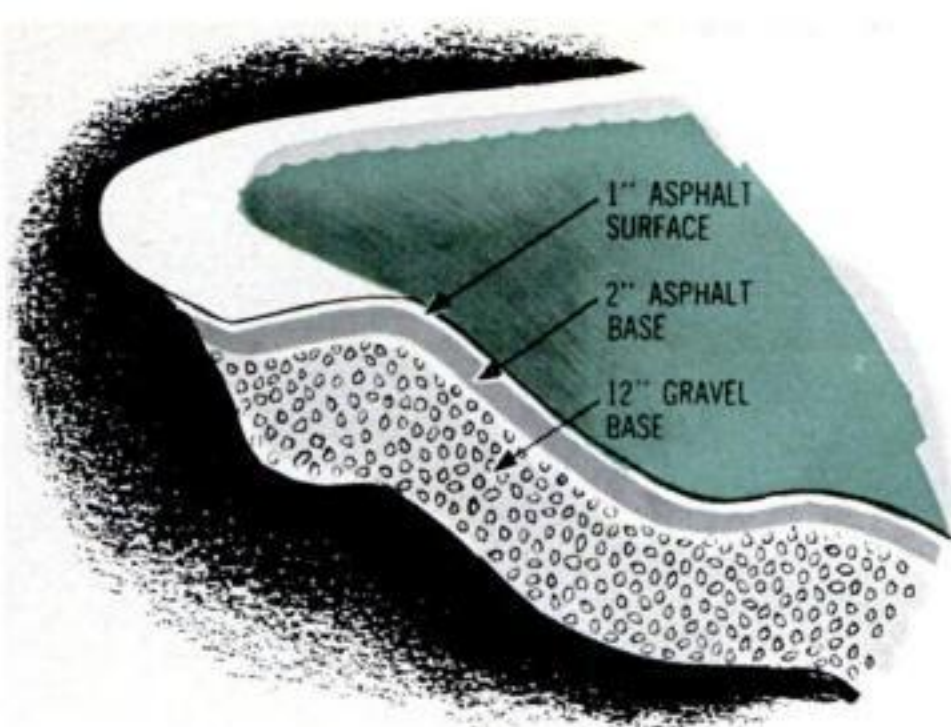
Filling and dumping. A 20'-by-40' pool with an average depth of 4' requires 24,000 gallons of water. Even portable pools hold 6,000 to 12,000 gallons.

How easy it is to fill your pool—and empty it—will depend on its size and how often you change the water. (To estimate a pool's needs, multiply its size in cubic feet by $7\frac{1}{2}$ to find the number of gallons it holds.)

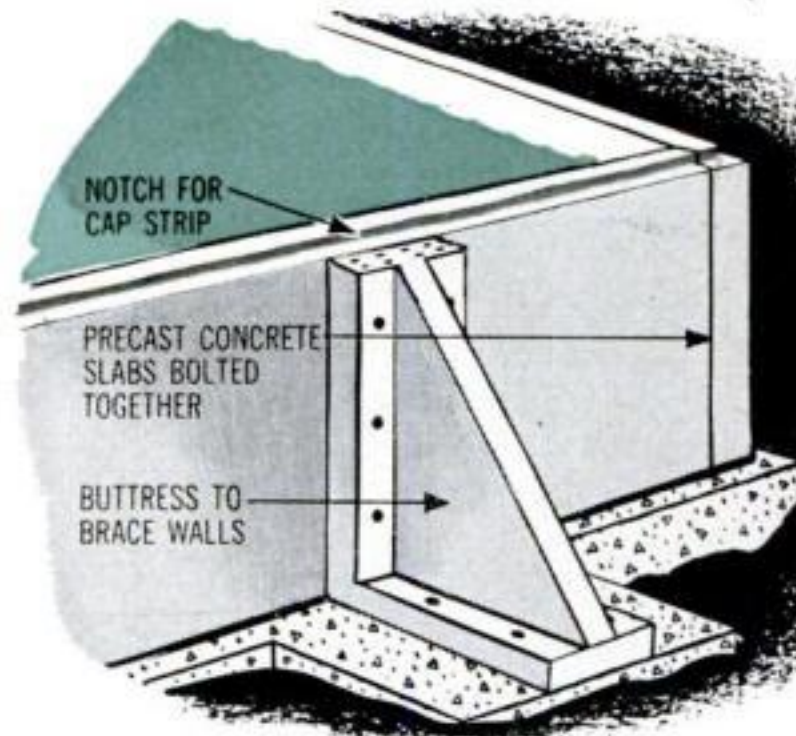
In a fill-and-draw pool—one that's periodically filled and dumped—the water is usually changed every few weeks. In a filtered pool, it's constantly recirculated through a dirt-trapping filter—you can fill the pool once and use the water all summer. The trend today is toward filtered pools, but you have to allow \$400-\$800 or more for the equipment.

The easiest way to fill a pool is from a water main if you have one. Most authorities agree that where municipal water is already plentiful, you probably won't have trouble getting enough. But if there's any chance of dry spells, you'd better figure on a recirculation system. In some of the presently arid western states, you couldn't fill a pool at all.

At city-water prices, it will cost from

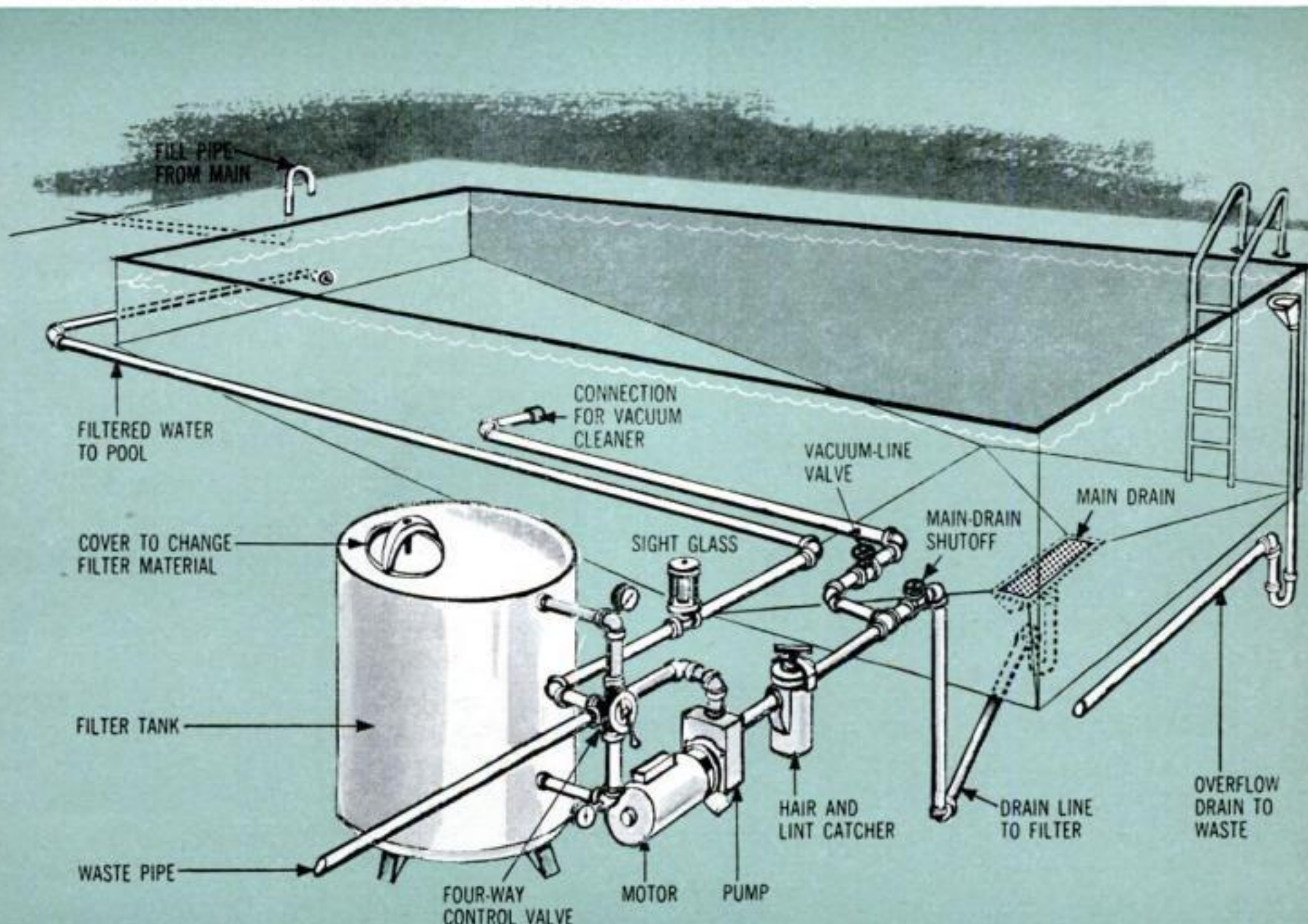


ASPHALT laid over gravel base does not permit vertical walls, but is very watertight and makes inexpensive slope-sided pool. It can now be colored to avoid black look.



PRECAST SLABS provide strong, dense concrete. Pool's walls are braced every few feet, can be made to stand above ground, but are limited to straight designs.

How a modern recirculation system works



DIRTY WATER is pumped from deep end of pool into filter tank containing a very fine, sandlike material that traps impurities. Clean water is then drawn from tank and returned to shallow end of pool. Con-

nection at side of pool is for underwater vacuum cleaner. Separate fill pipe, above pool level, stops seep-back from contaminating your source of water; is mandatory if you fill from a water main. Filter is run eight to 12 hours a day.

\$8 to \$15 every time you fill your pool—another reason for considering a filter. Usually a direct connection is made to the water main (filling from a garden hose would take several days). The charge for tapping into the main, installing a separate water meter and running pipe will cost another \$200 to \$300.

Another connection must be made to drain the pool—easiest into a sewer. In some communities, you may be required to spread the flow-out over several days to avoid overloading the sewage system.

If you don't have either water main or sewer, you may be in for trouble. Most wells won't handle a non-circulating pool, although they may be adequate to fill a filtered pool once in early summer.

If you have a septic tank you can't, of course, drain water into it or anywhere near its drain fields. Since these fields are usually located on the best-drained part of the property, you may not have another good place to drain the water.

If in doubt about either adequate water supply or drainage, get the advice of an expert first—there's nothing more useless than a pool without water in it.

How much can you do yourself? Engineers do not recommend that you undertake a large pool-building job unless you're highly experienced. A 20'-by-40' pool, filled, weighs about 200 tons—you're dealing with powerful forces.

You can make substantial savings, however, by assembling one of the smaller kit pools and by adding your own walks and landscaping. The 12'-by-27' pool that Sears sells for \$799 in kit form costs \$1,700 installed—more than double. Allowing \$400 for excavation, concrete blocks and other costs, you could save about \$500 by doing the work yourself.

Some pool owners have cut costs by buying the materials and having a local mason or builder do the job. However, a professionally built pool is likely to be better—and it comes with a guarantee.

How much for "extras"? A ladder costs \$40 to \$230. You'll also need a special underwater vacuum cleaner to suck dirt from the bottom, if you don't want to drain the pool periodically for

cleaning. These run from \$50 to \$200. For fancier extras, you'll spend \$60 to \$200 for a diving board, \$50 to \$100 for underwater lights, \$500 or more for a pool-heating system.

Safety measures should include either a fence or pool cover. You can build an inexpensive enclosure with wood-slat snow fencing, but a steel-mesh type may run to several hundred dollars (open fences, such as post-and-rail, will not keep out children and animals).

Plastic covers that fit over the top of a pool are available for \$50 to \$200 and have the added advantage of keeping out dirt as well as people.

How much for "operation"? Contrary to what many believe, a filtering system *does not purify* a pool—it keeps it clear. The same chemicals must be used to treat a filtered pool as an unfiltered one, and in about the same amounts.

Chlorine is used for purification and must be added to the pool *every day*—about one pint to 20,000 gallons. Other chemicals are used to kill slime-producing algae, to control acidity-alkalinity (pH reading), and to precipitate dirt.

For \$10, you can get a chemical test kit that will measure chlorine content and pH. A quick test will determine water cleanliness: You should be able to see if a dime at 8½' depth is "heads" or "tails."

Most pools require painting every two or three seasons, and this can run from \$35 to \$50. Plastic liners must be replaced about every five to eight years, at a cost of \$300 to \$800. Allowing for chemicals, paint, water, electricity and repairs, you can figure on spending about \$250 a year to run your pool.

A wintertime skating rink? Pools used to be emptied each winter, but now experts have found that it's best to keep them filled. The water, which freezes only on top, keeps the bottom of the pool warmer and weighs it down.

In cold weather, this gives you a free skating rink as a bonus. The ice will slide up slope-sided pools without damage. In vertical-sided pools, lash logs around the edges as buffers. END

"If you repair Mr. Sullivan's set, none of us will ever call you again!"



Audio circuits, and customers, go on a rampage as a repairman tracks down reasons—

Why TV Sets Produce Squawks

By Art Margolis

MOST of us still think that a TV picture flying invisibly through the air is miraculous. Yet the sound that also makes the trip is taken for granted. Only when the sound lets out a squawk or quits altogether do we take notice of it. Then the customer lets out a squawk, and a TV serviceman like myself is called in to repair the damage.

When audio ailments turn out to be

something other than tubes, they can be stubborn to cure. Tracking down the minute differences between muffles, volume losses, buzzes, hums and squeaks is tricky, as you can see.

The Loud, Loud Late Show

ONE evening I received a call from a retired, redheaded railroad engineer, Mr. Sullivan, who lives in an apartment building that also houses a number

of my other customers. I've been servicing their sets for about five years now.

This night Mr. Sullivan was characteristically blunt. "The dang TV don't talk right," he told me on the phone.

I had scarcely parked my truck when I was met by an angry, grumbling crowd—my other customers who lived in the same building. One particularly belligerent tenant was thumping my chest with a giant forefinger and saying, "If you repair Mr. Sullivan's set, none of us will ever call you again!"

It turned out that Mr. Sullivan, who is slightly hard of hearing, had become addicted to late, late shows. His audio blasted loudly all night through every window on the air shaft.

The angry crowd followed me and stood glaring in the doorway. I turned the volume control all the way up. The sound was low and muffled. The announcer sounded as if he were talking with a big ball of cotton in his mouth.

At the TV studio the announcer was speaking correctly. But somewhere along the complex electronic journey from his mouth to my ears his pear-shaped tones were being snafued. As he spoke, a sensitive diaphragm attached to a coil in the microphone translated the air waves of his voice into alternating electric current. The audio frequencies (AF) of this current range between zero and 15,000 cycles per second.

This AF is injected into the station's carrier wave so that it modulates the frequency of the carrier (FM). The modulated carrier travels through the air, is picked up by the TV aerial, then funneled into the set to the FM radio section. The audio section must then undo all the work the station went to the trouble of doing. Extracting the audio frequency from the carrier wave is called detection or discriminating.

The discriminator in Mr. Sullivan's set works this way. It is tuned exactly to the carrier wave. When the carrier enters the discriminator at its prescribed or center frequency there is an output voltage of zero. As the frequency moves above and below center frequency, a

voltage is developed in proportion to the shift.

The modulated carrier was moving around center frequency in accordance with the announcer's voice. I checked all the test points in the audio circuits for their voltage and resistance readings. They all read correctly. So I asked myself what parts could become defective and not affect any of the test-point readings. There were two possibilities: open condensers or a few shorted turns in the discriminator transformer. I checked the transformer by installing a new one.

That did it. The audio blasted loud—but was still muffled. I took a nonmetallic screwdriver and touched up the top and bottom adjustments of the new discriminator transformer. Pear-shaped tones came in nice and clear. Mr. Sullivan looked happy. But the doorway audience had murder in their eyes.

Then a light bulb lit up in my head. Instead of allowing the loudspeaker to blast away, I installed a set of earphones for Mr. Sullivan—and everyone was happy.



The Horse Players' Special

THE customer on the telephone said, "The sound is almost gone."

Routinely I asked for the address. Just as routinely he answered, "Track 14 between four o'clock and four-thirty this afternoon."

The TV set was in the lounge car of a crack streamliner called the "Horse Players' Special," and they wanted me

to repair it while the train loaded up during a half-hour servicing stop.

I swung aboard as the train slowed and was already checking the audio tubes as the passengers began to move out. But I had no luck—the trouble was under the chassis. I took the set down from its perch and pulled the chassis out on the floor. Meanwhile a few people gathered to watch. Twelve minutes elapsed. I noticed that one sharpie was watching me carefully.

Trying not to rush, I analyzed the symptoms. There was some sound. It was clear, but very low. The volume control varied it correctly. This indicated that the detector-output voltage was okay. The trouble should be further down the sound path.

After the audio is extracted from the carrier, it must be amplified, for its voltage is too low for use. Beyond the detector comes the audio-amplifier section. The audio voltage is developed across a variable resistor, the volume control. The center tap of the volume control feeds the audio through a condenser into the control grid of the audio amplifier.

Since the trouble appeared to be in the audio amplifiers, I set about signal-tracing them. Meanwhile another five minutes had elapsed. The onlookers began to buzz, and I heard the sharpie making book on whether I'd finish.

I took a piece of wire, attached a .01 condenser to one end and the filaments of a handy tube to the other. Then, with the set on, I touched my makeshift condenser probe to the center tap of the volume control. Nothing happened. You see, the filament voltage is 60 cycle, which is in the audio range. It would travel through the audio-amplifier section and be heard out of the speaker if the audio amplifier was working right.

But I heard nothing. This meant the trouble was farther along the path. Another five minutes had passed.

I took the probe off the volume control and put it on the next point—the other side of the condenser leading to the audio-amplifier grid. A loud, welcome 60-cycle hum burst out of the speaker.

The crowd murmured excitedly. The 60-cycle wasn't passing through the condenser. That indicated the condenser was open. Quickly I replaced it. I looked at my watch. I had four minutes left. I turned on the set. I was home—the sound blasted loud and clear.

I put the chassis back in the cabinet and got the set up on its perch, just as I heard a loud "All aboard!" The train gave a lurch. I grabbed my gear and stepped off just before the train cleared the end of the station platform.

The next morning I had a visitor. It was the sharpie from the train. He handed me \$10 and said, "Your share of my winnings when I bet on you."



Monkeyshines in a Maternity Ward

A FEW weeks ago I found I had two reasons for going to the hospital. One, my kid sister, Rusty, had given birth to a daughter; two, there was trouble in a patient's TV set. I arrived at the hospital during visiting hours and found most of my clan, but conspicuously missing was the proud father, Bob.

Making sure all was well, I excused myself to visit the other reason I was there, the ailing TV. When I first turned on the set, it seemed fine. Then the picture slowly became blurred and the sound went from crisp to garbled. I turned off the set and tried to reason out the problem.

After the audio is amplified somewhat in the audio-amplifier stage, it is fed

through a condenser to the audio-output amplifier, which builds it up enough more to drive the speaker. But as AF is processed from point to point, it hits different DC voltages. Plate output of the audio amplifier is about 200 volts. Grid input of the audio-output amplifier is around 125 volts. These voltages must not mix, yet the AF must pass from one to the other undisturbed. A blocking condenser is placed between the two points. This blocks off the DC yet lets the AF pass freely.

I put my voltmeter probe on the grid input of the audio-output tube, which is supposed to be at 125 volts. Then I turned the set back on. My meter needle showed 125 volts. Then as the picture and audio both began to blur, the voltage rose: 130 . . . 135 . . . 140 . . .

Where was the extra DC voltage coming from? Only one place: After the set was on awhile, the blocking condenser was developing a leak and allowing some DC through. That was why the sound became garbled. The picture blurred because the DC voltage was also passing through the focus coil, changing the focus voltage. I replaced the condenser. The sound and picture came back fine.

Back in my sister's room, my brother-in-law hadn't shown up yet. Rusty looked disappointed. As I left, Bob pulled up. He had been caught in a traffic jam and had missed visiting hours.

I took Bob over to my truck, changed shirts with him, installed my hat on his head, inserted a tube caddy in his hand and he was off. I knew he'd have no trouble getting to see Rusty—as long as he didn't monkey with the TV.

The Buzz That Bit

RECENTLY a new doctor moved into our neighborhood. When he called me for TV service, I found we were old acquaintances. He was "Old Ironhands," a doctor who was with our division in the service. He had the reputation of being a terrific MD, but as his nickname implies, his touch was not the gentlest.

I found his set had an erratic buzz, in



time with a bad vertical jitter in the picture. This indicated trouble in the vertical section that was somehow also affecting the audio track.

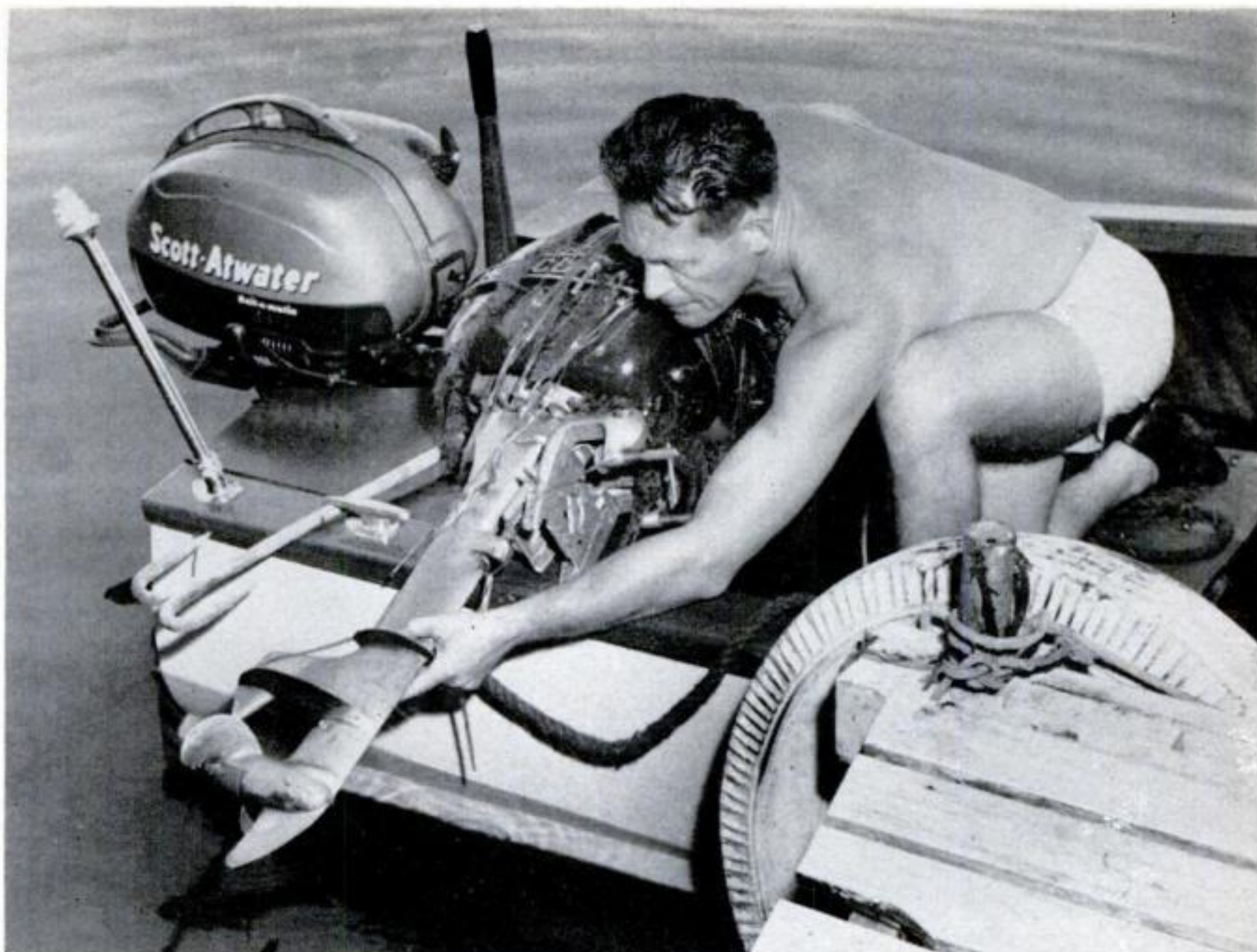
I pulled the chassis out of the cabinet. Old Ironhands hung doggedly over my shoulder. I disconnected the speaker and could still hear the buzz, but only very faintly. The fact that I could hear it at all suggested that it had a mechanical and not electronic aspect.

I rolled a piece of paper into a funnel stethoscope and began probing under the chassis for the exact location of the buzz. When the paper alighted on the vertical-output transformer I heard the buzz. The transformer laminations had loosened and the windings were vibrating. Their movement developed extraneous AF voltages that were transferred into the audio section. There the unwanted AF was amplified and aired as a buzz.

When Old Ironhands saw I had found something, he grabbed my makeshift stethoscope and listened. I saw him reach, but before I could say anything, he put his hand on 300 volts DC. It seemed to me that his eyes protruded, his hair stood up, his ears went purple and he rose about four feet in the air. As he settled back down to earth, I thought: thousands of man-handled GIs have just been avenged.

I put in a new vertical-output transformer, extracted my fee and departed chuckling.

But my chuckles didn't last long. When I arrived home I found a message from my insurance man to get a physical examination for my new policy. Guess who the doctor was? END



What to Do About a Dunked Outboard

Fast action can prevent water damage. Fish it out quickly and get to work on it at once.

By E. F. Lindsley

WHEN an outboard motor breaks loose and goes to the bottom, you have a very important decision to make after you have finally pulled it out: Can you dry it off and start it up again? Or should you first have it torn down and rebuilt?

How you decide depends largely on the answers to two other questions:

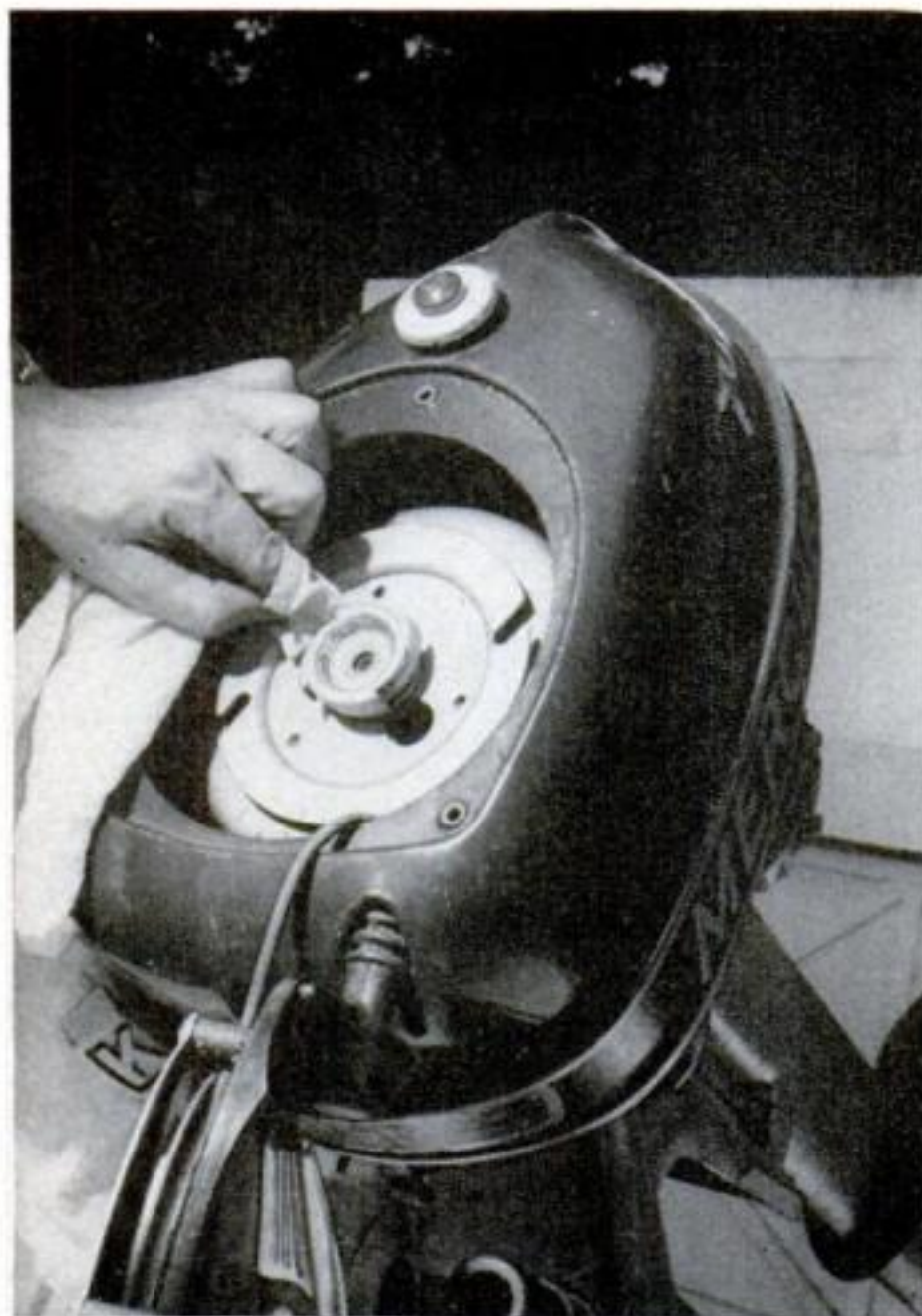
- What kind of bottom did the motor settle into?
 - Was it running when it went down?
- Until you have made a survey of pos-

sible damage, *do not turn the flywheel* or you may cause serious damage where none existed before.

By itself, water in a motor is not too damaging. Plain water can be poured, pumped, blown and wiped out. If done fairly soon, little harm will result. The odds are in your favor for safely starting up the motor if the immersion was short and the bottom solid.

But lakes, rivers and oceans have bottoms of silt, sand and other muck. A plastering with any of these suggests strongly that you beat a hasty course to your dealer's shop for an overhaul.

What if the engine was running? When a motor turning at high speed drops in the drink, it gulps in huge slugs of water. If a fast-moving piston rams



CAREFUL DABBING with dry rags and pipe cleaners will soak up much of the water that has gotten inside. Bright sunshine or an infrared bulb will also help dry out the motor.



TIP MOTOR FORWARD like this to let water drain through carburetor inlet. First, however, drain engine in upright position to avoid washing dirt back through the exhaust ports.

up against a combustion chamber full of incompressible liquid, something's got to give. Usually, it's a connecting rod.

In that case, the best first aid is to drain out the water, pour in plenty of oil and rebuild the power head. Never try to pull the engine over if you feel a drag or resistance with the plugs out.

Fortunately, except in racing circles, this type of dunking happens infrequently, since modern outboards are fettered by remote shift, throttle, steering, fuel and electrical cables. A safety chain provides additional insurance.

Fish it out quickly. Once a motor is dropped in the water, there's a brief period of grace when quick removal will probably save a major operation. During this period, especially in shallow water, the inlet valves and rather complex porting will probably trap enough air to exclude water and dirt. Later, as the air seeps away, water will enter. The construction of the typical two-cycle out-

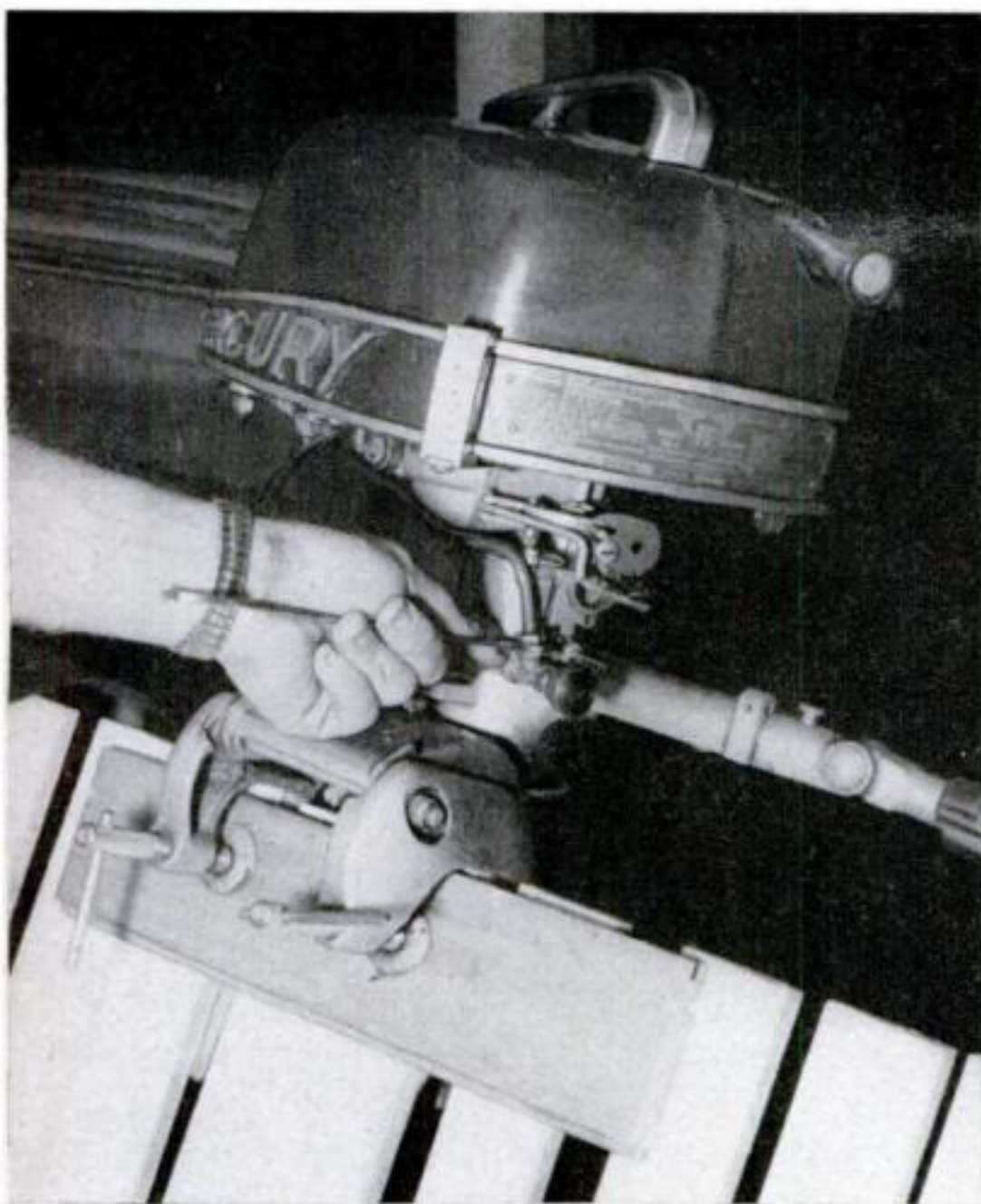
board permits anything going in through the open carburetor to wind up in the crankcase once it's past the inlet valves. Hence the need for a quick rescue.

If circumstances force you to leave the motor in a silt or clay bed long enough for mud to force its way into the coolant, exhaust and carburetor passages, forget about home remedies. Disassembly and rebuilding are a must.

Eight first aid rules. If an early rescue is made from a sound bottom, try:

1. Mount the motor on a stand, remove the housing and air-intake silencer (if used) and inspect the carburetor inlet for traces of sand and dirt.

2. Tilt the power head down to drain water out through the carburetor. If muddy water or sand comes out, that's the time to take the motor to the shop. Some motor manuals recommend removal and flushing of the carburetor. This is fine, if you have the tools, because it permits access to the inlet valves.



GAS TANK and fuel line will usually need to be drained and flushed. If you are working in a shop, leave this operation until last—and then for safety do it in the open air.

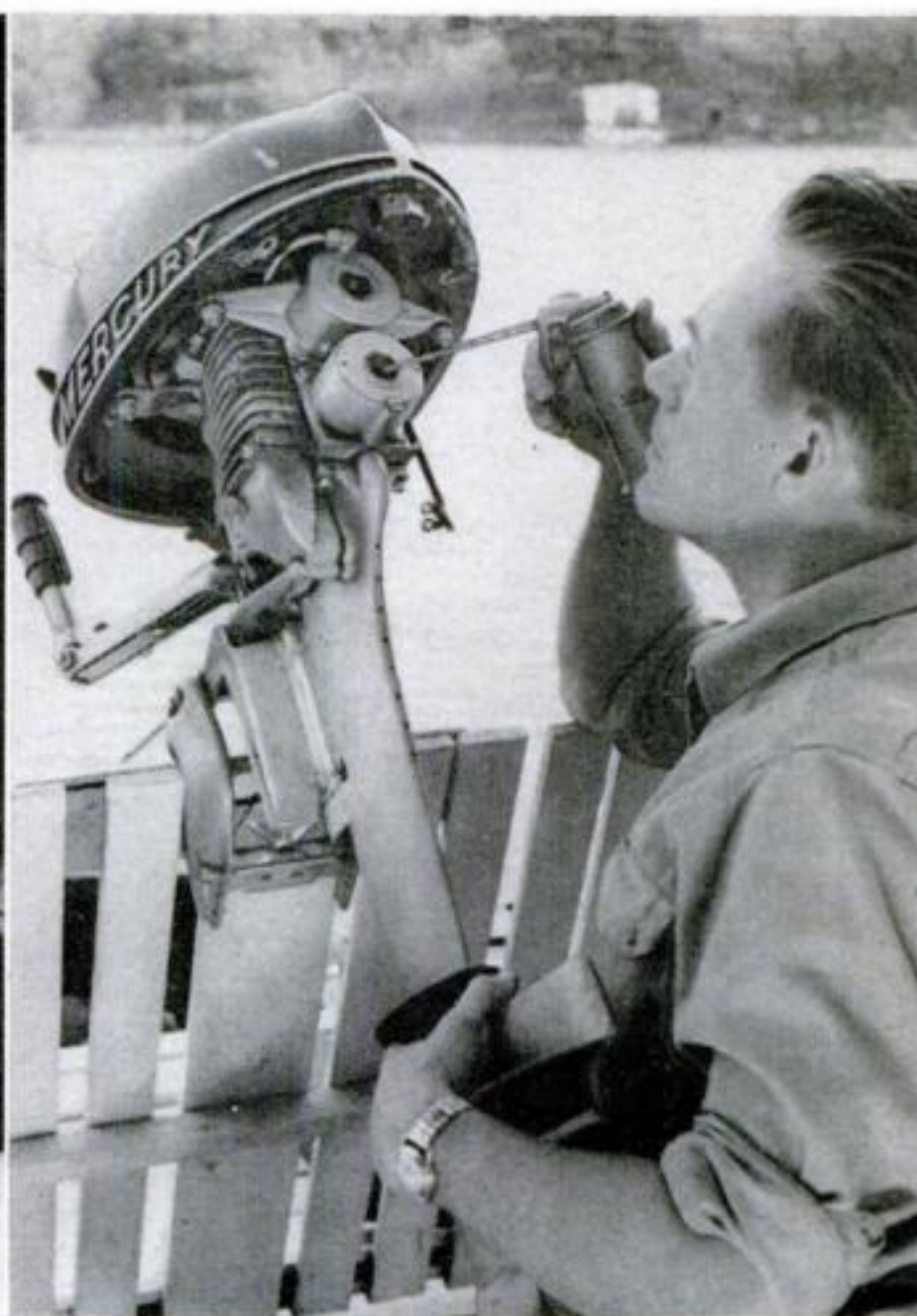
If you lack the tools or the skill, and the water was clean, just pour it all out.

3. Tip the motor back and remove the gas line if you have the type with the tank on top. Flush the tank and line clean with a fresh gas-oil mix.

4. Pull the spark plugs and dry them off. If you have a small flashlight, peek into the cylinders and squirt light engine oil in on them.

5. Very carefully turn the flywheel or pull the starter rope slightly. Listen carefully for any scraping or gritty noises. If you hear any, take the motor to a shop.

6. By now, the magneto should have drained fairly well. If you've had experience in pulling the magneto flywheel, remove it and wipe dry the coil, points and wiring. Flywheels that are extremely tight should not be hammered or pried. This raises hob with crankshafts and bearings. If your magneto has inspection holes, try drying the points with a soft dry cloth or pipe cleaner.



PLENTY OF LIGHT OIL is in order even though the engine is dirty or damaged and can't be restarted. Shoot it in liberally at all possible points as soon as you have the water out.

7. If you're now satisfied that the engine has no internal dirt, attach and ground the spark plugs, pull the starter and check for spark. A weak spark or none at all is not necessarily serious, since modern ignition coils are well protected against moisture. Water is probably shorting the external wires. Dry the magneto with an infrared lamp, bathroom heater, or some other source of mild heat. Never use anything really hot that might melt or burn insulation. If you've hauled the motor into your cellar or garage, watch out for gas fumes.

8. The motor should now be ready to start again. Before doing so, don't fail to clean and relubricate the many little control links, cams and switches.

The main rule of thumb to remember is: Never turn the flywheel until you're sure that no sand or dirt has reached the inside. If the motor can't be started, give first aid to prevent rusting—but no dockside overhauls. **END**

Here are important details you should know about—

The Saw That Cuts Its Own Starting Hole

By George Daniels

UNTIL a few years ago you drilled a hole first when you wanted to start a saw in the middle of a wide expanse of wood. But no longer. Now, you simply rock the saber blade of a new type of saw into the wood and start cutting. It's that simple.

This saw is so new that makers haven't yet agreed on what to call it. Most tend to designate it as a portable jigsaw; others lean toward saber saw.

But whatever you call it, this fist-size package is definitely not a toy. It's a valuable tool, a worthwhile addition to any shop. It combines the cutting ability of a bulky, bench-mounted jig- or band-saw with the convenience of a jackknife. It has no throat to limit the size of the stock it can handle. It cuts fast (the 2'-capacity models will zip through a two-

by-four in approximately 14 seconds). And the saber blade's more than 2,000 strokes per minute help it follow straight and curved guide lines with surprising ease and accuracy.

With a change-over of blades that takes about 10 seconds, you can use a portable jigsaw for rough cutting, smooth cabinet-finish cuts, or to breeze through sheet or tubular varieties of metal or plastics. A special, knife-edged blade gives a neat, square-edged cut through leather or foam rubber for upholstery work.

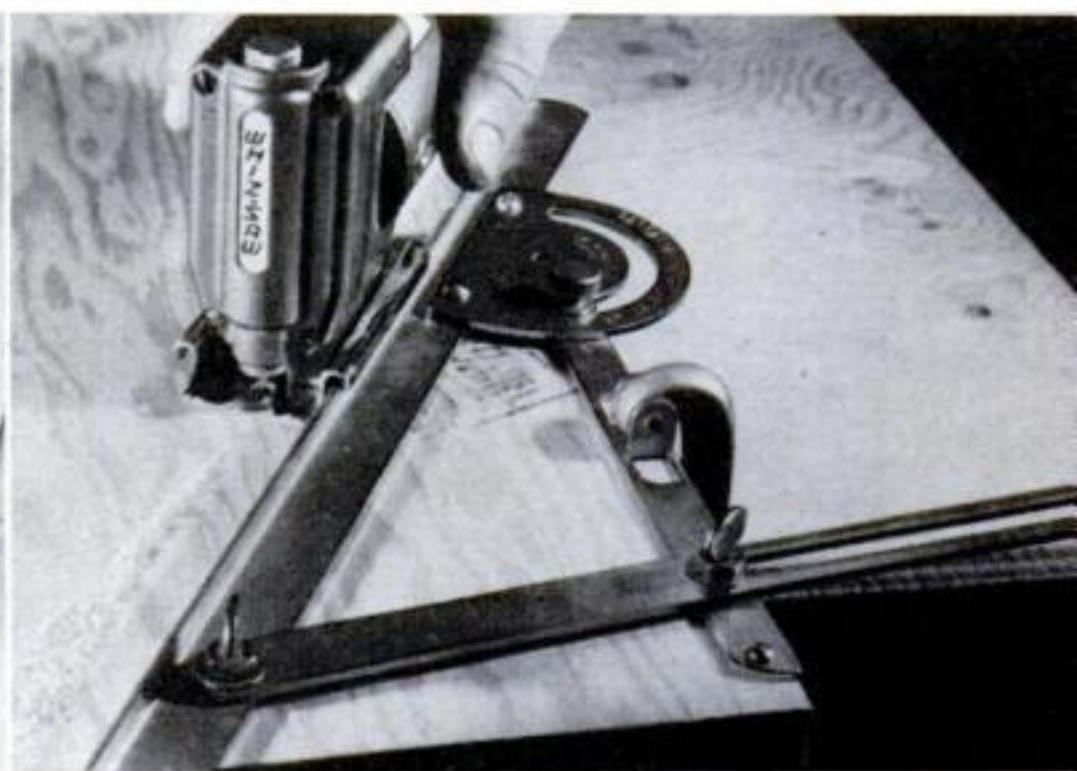
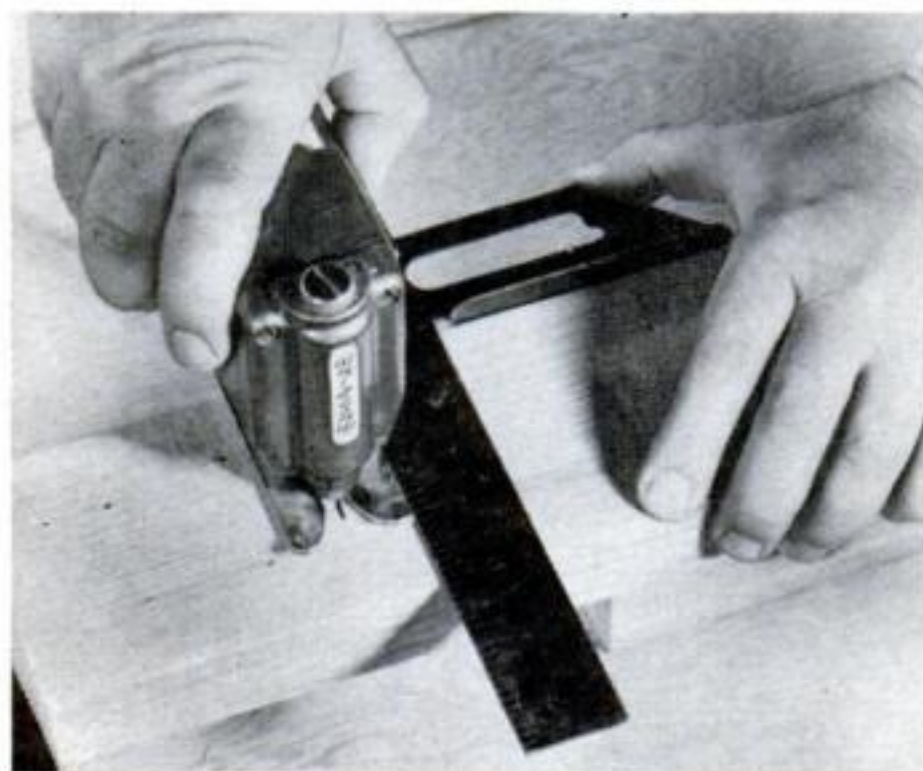
Compact and light (3½ pounds for a typical home-workshop model), the saw is an ideal on-the-spot tool. When fitting shelves or built-ins around interior trim, or against irregular walls and corners, there's no need to trundle marked stock from the job to your shop for cutting. A

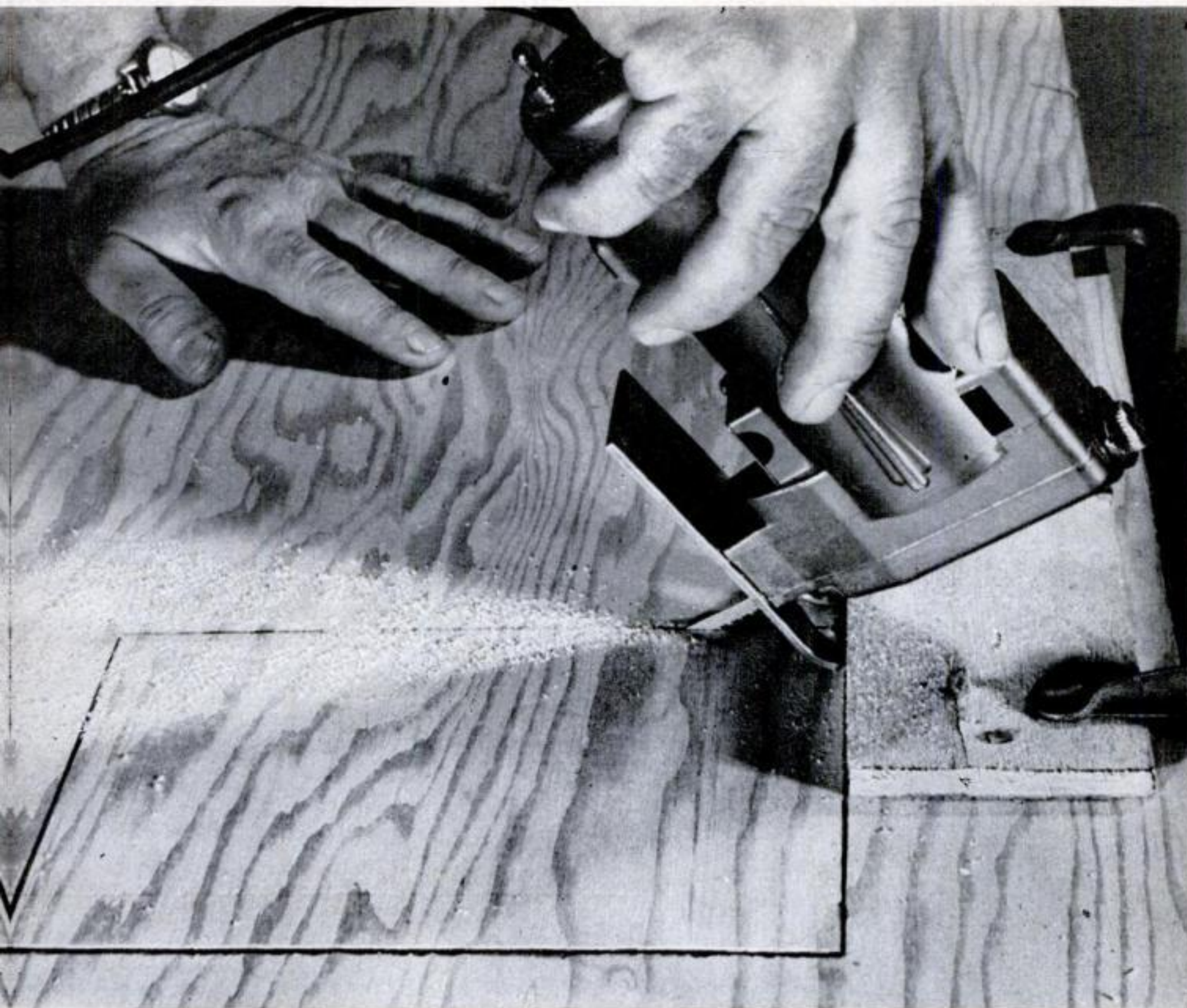
[\[Text continued on page 172\]](#)

Cutting along a straightedge is simple and precise

BUTT GUIDE-SHOE SIDE AGAINST TRY SQUARE, batten, or any other straightedge for fast, accurate crosscutting or ripping. If the saw tends to waver away from the straightedge, check the position of the blade in the locking device. When properly inserted, tightening the back-up

screw under the knurled cap automatically aligns the blade with the guide-shoe sides. The manufacturer of the saw pictured below offers a channeled shoe that fits over rail on adjustable-angle guide, preventing weaving even if the blade is slightly misaligned.

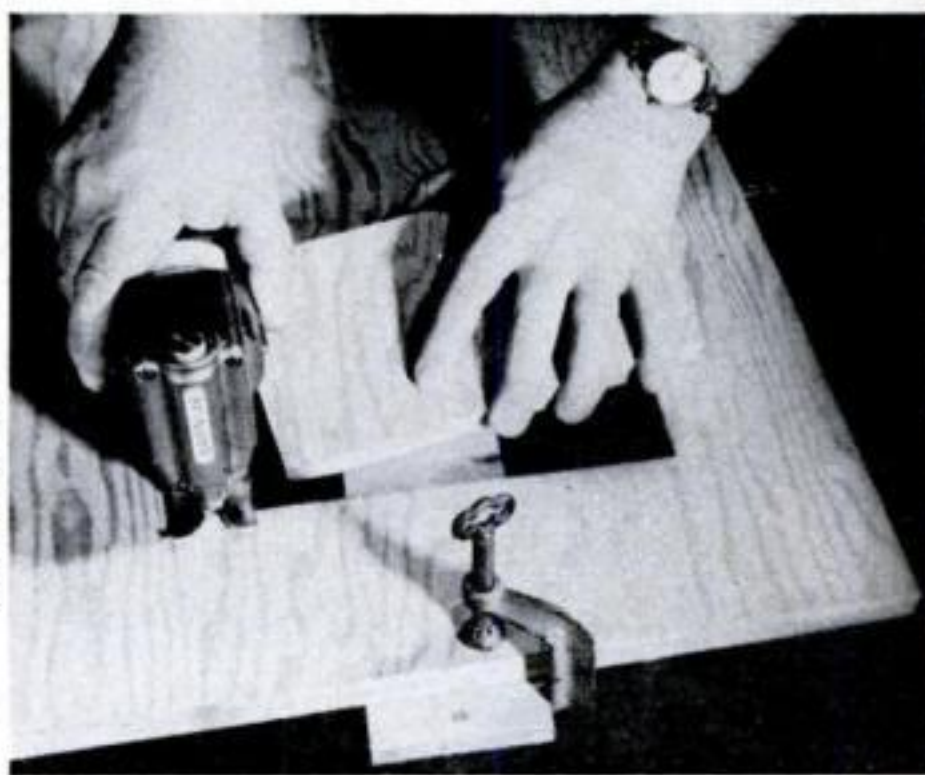
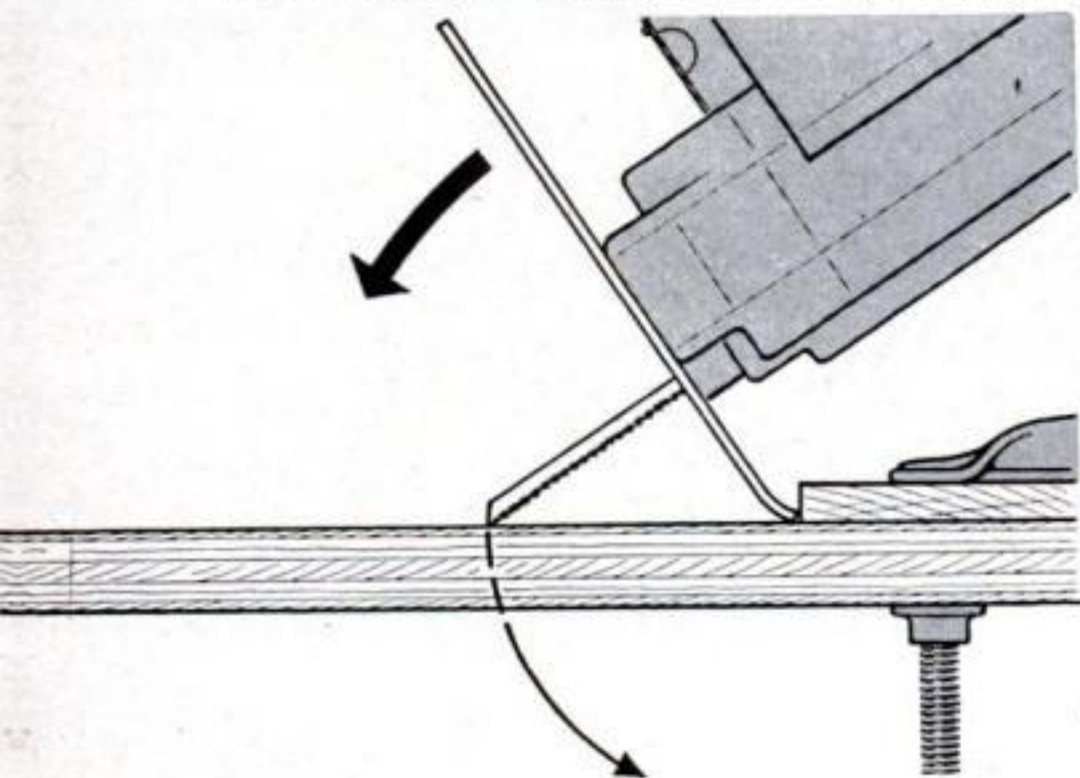


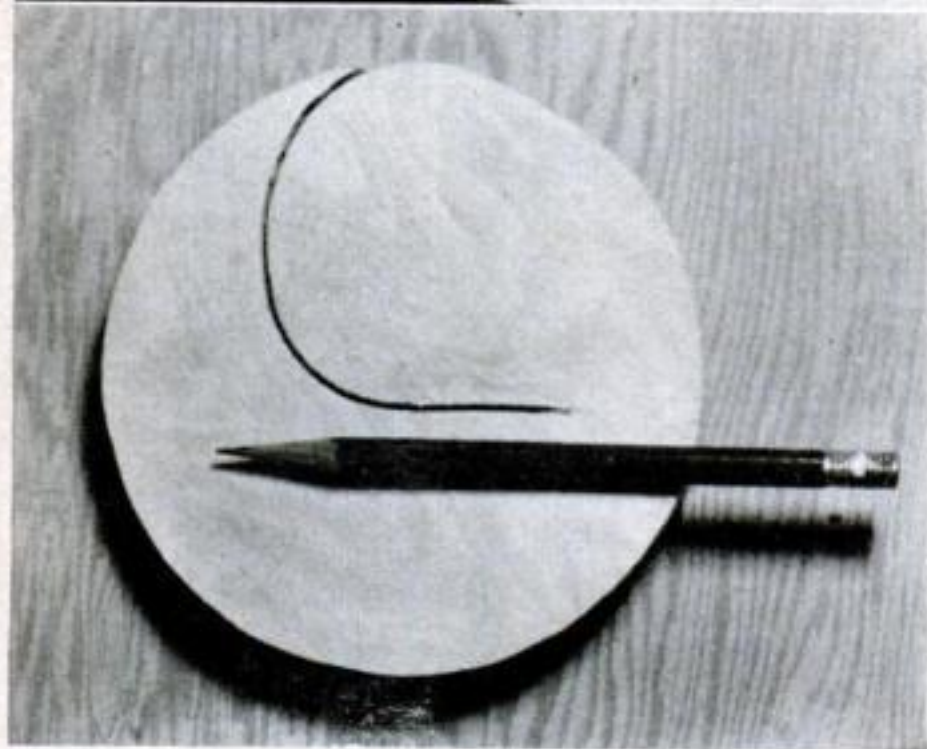
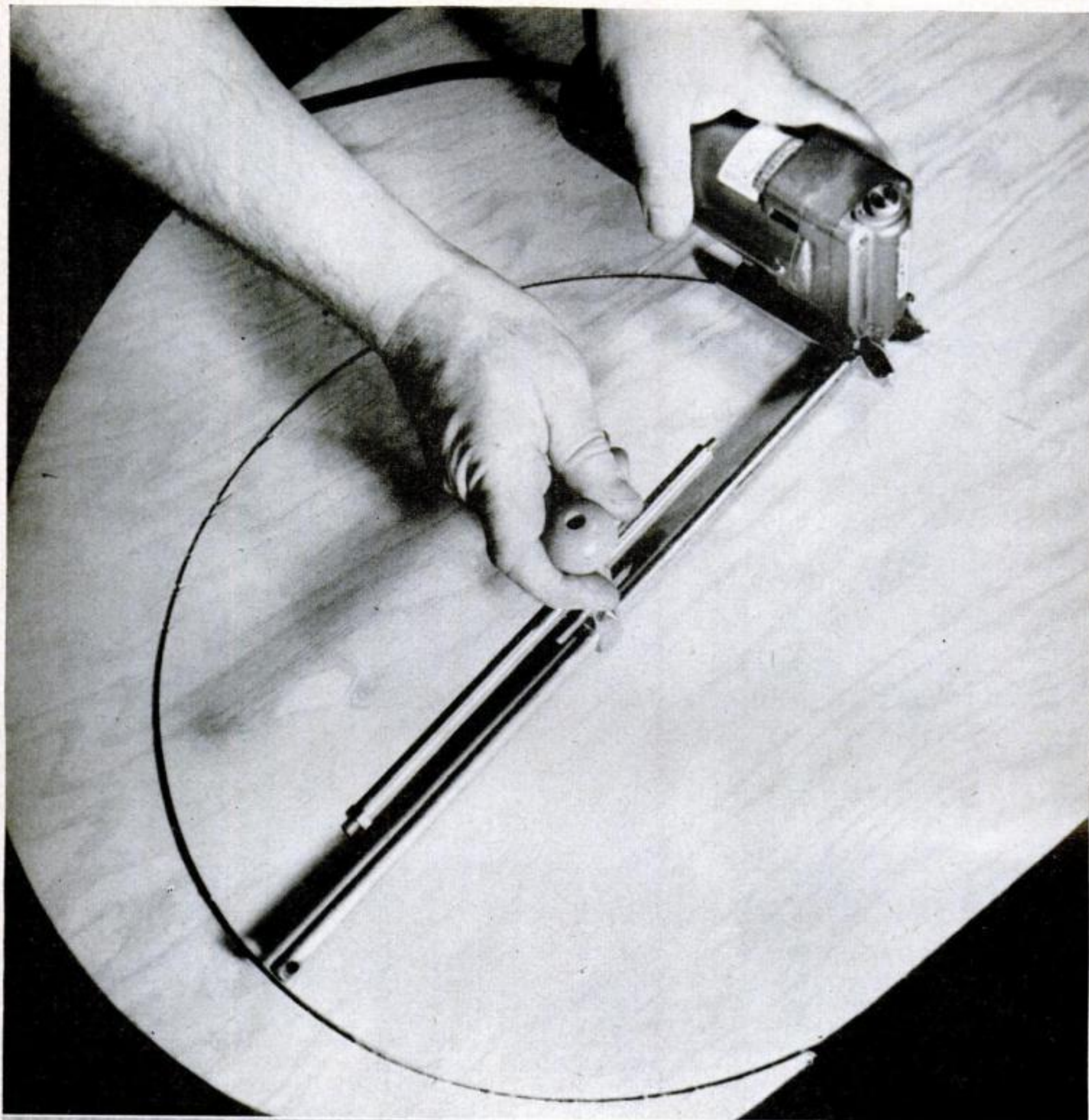


It makes an inside cut without a starting hole

TILT SAW FORWARD, with tips of guide shoe pressed against a batten clamped at right angle to desired cut and blade just touching stock (below). Turn on saw and gradually lower rear of shoe until blade cuts its way through stock into vertical position. Remove batten and con-

tinue cut to corner. Lift saw out, reverse it and saw to opposite end of guide line. Repeat operation for each side. To prevent freed center section from jamming blade, clamp a backing block to the stock before making the last side cut, as shown below. *(Please turn the page)*



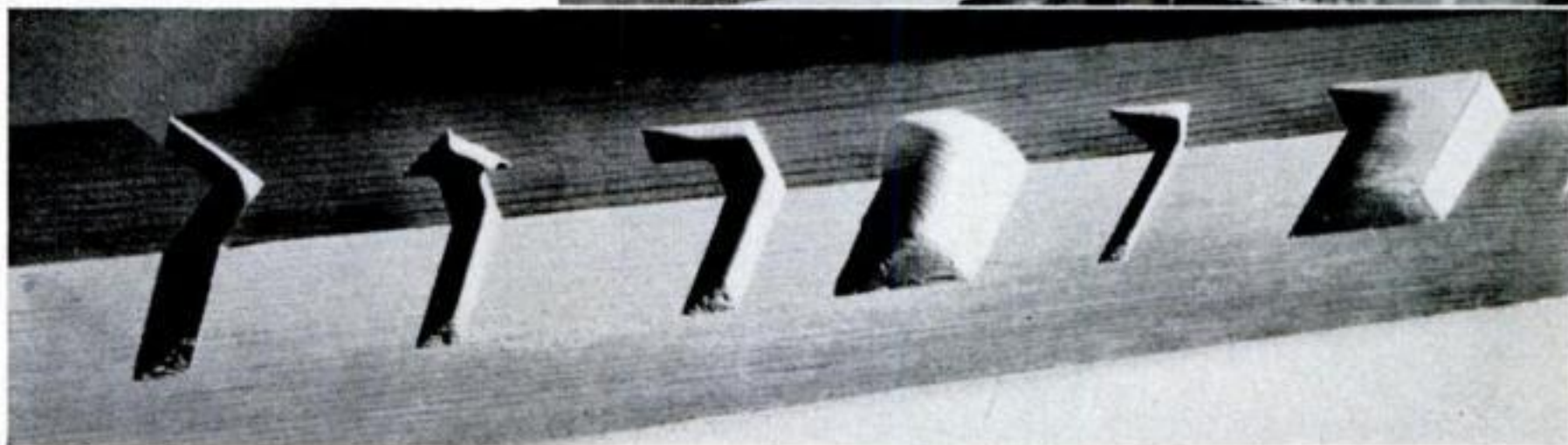
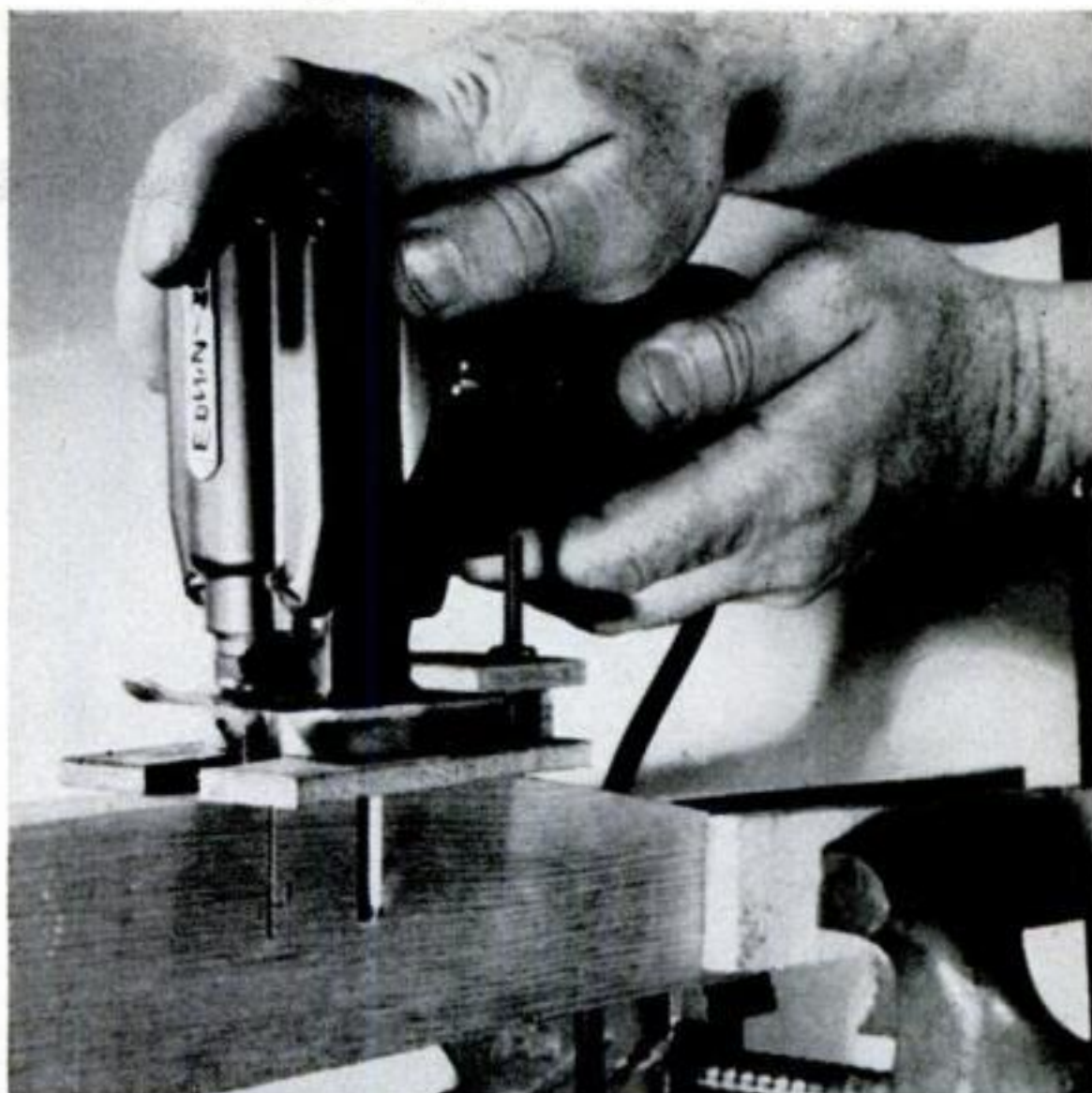
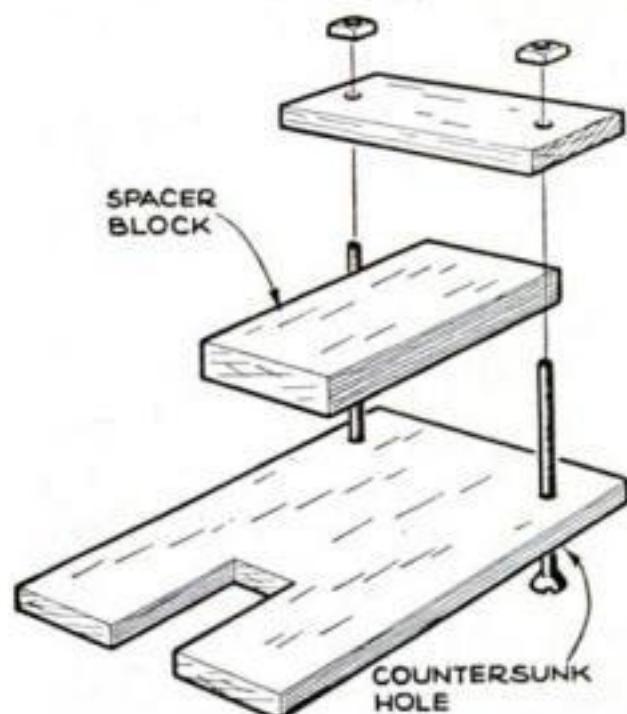


How to run off outside or inside circular cuts

ACCURATE CIRCLE-CUTTING is a cinch, whether you use a special attachment sold by some portable-jigsaw manufacturers (an arm and pivot fastened to the guide shoe at a 90° angle to the blade), or follow a compass line, freehand. To run off an outside circle with an attachment like the one shown above, place the pivot at radius distance from the stock edge. To cut an inside circle, first drill a pilot hole inside—and just touching—the circumference. When cutting an inside circle freehand, let the saw make its own starting slot and then spiral to the guide line, as shown in waste stock, at left.

An improvised shoe controls cutting depth

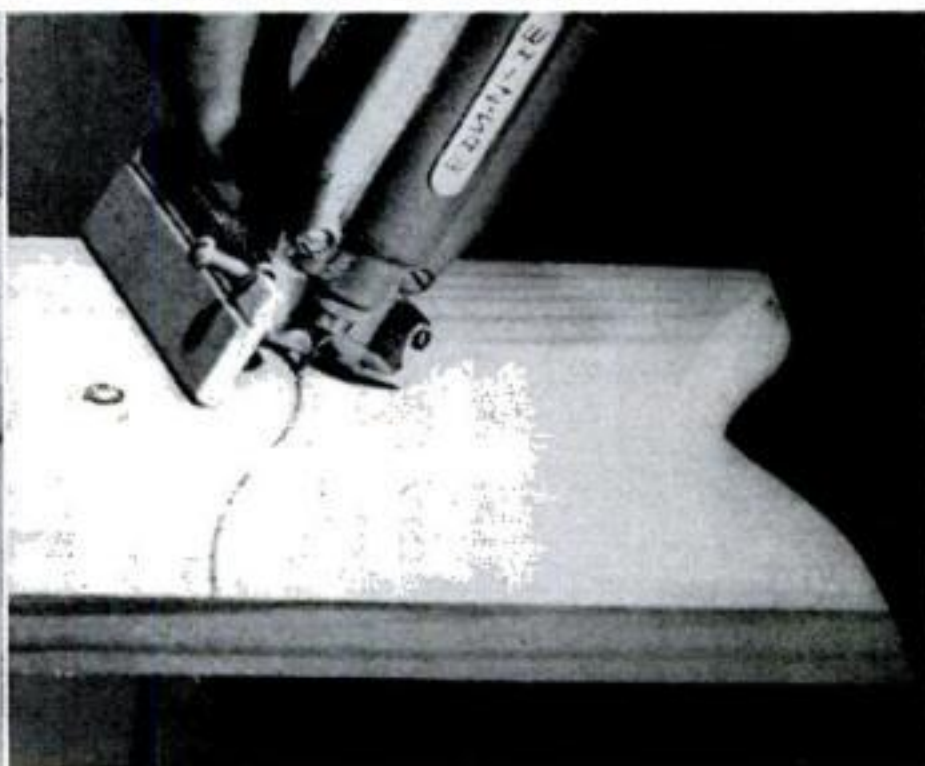
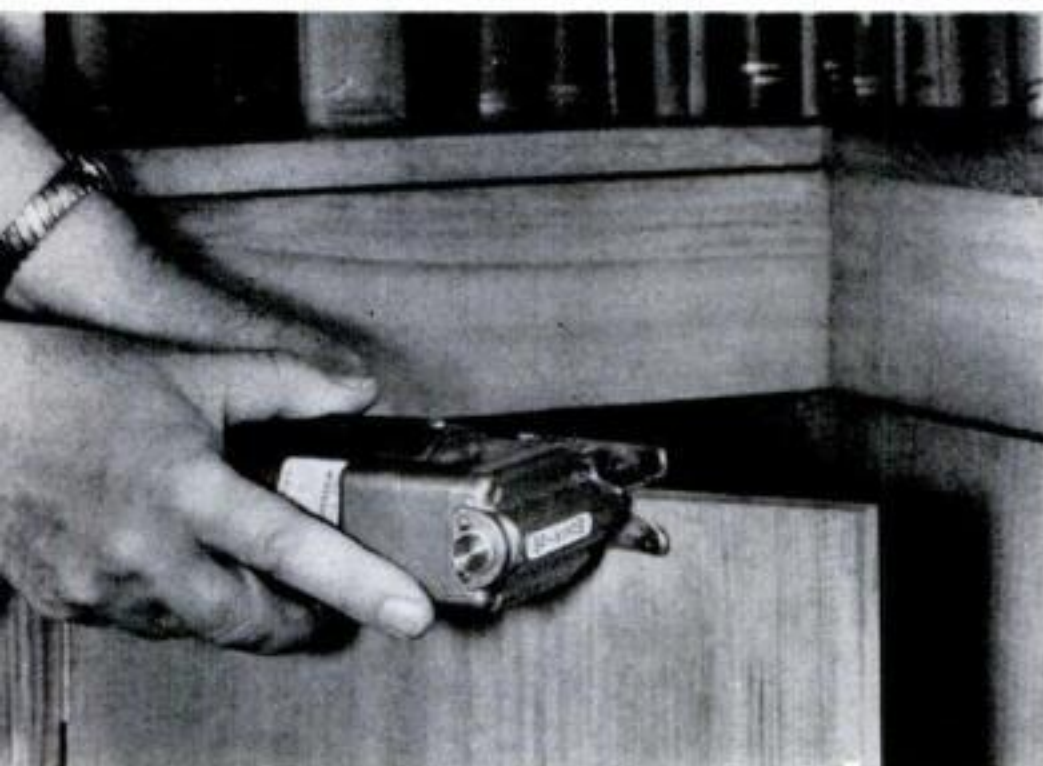
ELEVATE SAW for blind-mortise and lock-joint cuts of any desired depth by clamping blocking to underside of shoe. Make bottom cut with knife or chisel to part waste stock or, if cutout is intricate, chew away core with a succession of parallel saw passes. Below are a number of sample cuts you can make.



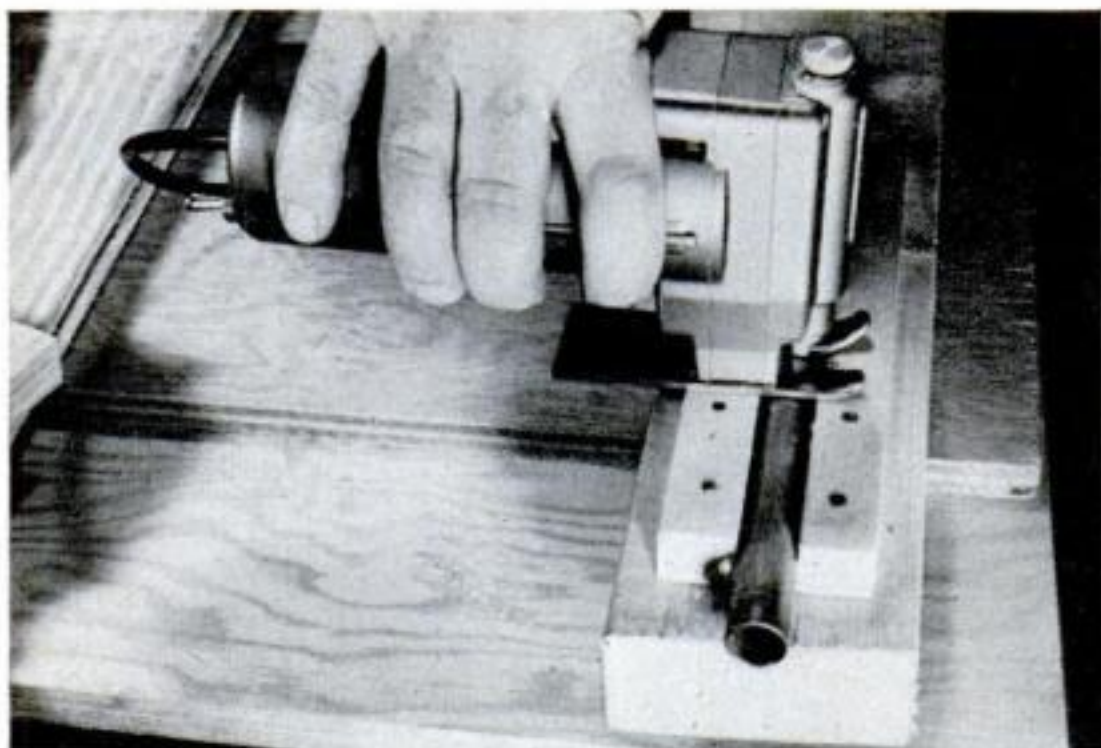
Want to shave an edge or cut a neat bevel?

NO NEED TO UNHINGE A CABINET DOOR for custom fitting. Just swing it open and run the side of the blade lightly along edges as many times as necessary to give clearance. Fine-toothed blade eliminates the need for sanding.

TILTING GUIDE SHOES on some portable jigsaws make bevel cutting easy. If the saw has a fixed shoe with channeled edges, a small strip of wood can be clamped in one channel to tilt the blade up to the desired beveling angle.



Simple setups help you cut tubing and sheet metal

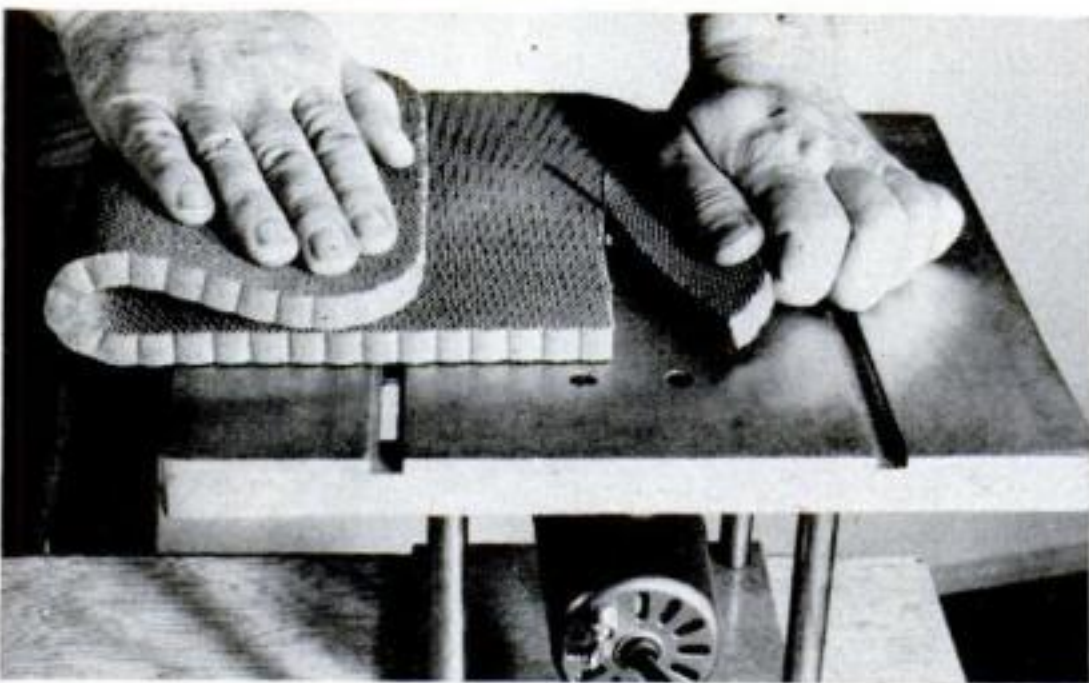


MITER-BOX-LIKE JIG made of scrap lumber insures accurate crosscuts through tubing. Battens should be slightly higher than stock diameter, and snug enough to prevent side play. Metal cutting calls for a special, fine-toothed blade.



THIN SHEET-METAL STOCK stays flat and chatter-free when you sandwich it between pieces of hardboard or crate plywood and clamp the assembly firmly together. Guide lines on board are easier to see than scribe marks on metal.

You can trim upholstery materials



LEATHER, FOAM RUBBER, and other upholstery materials are handled with a sharp-edged, toothless saber blade. For professional, vertical cuts in soft materials such as these, it's best to use a portable jigsaw table mount.

pair of two-by-fours, laid on the floor beneath the material, is all you need in the way of a "workbench" for a portable jigsaw.

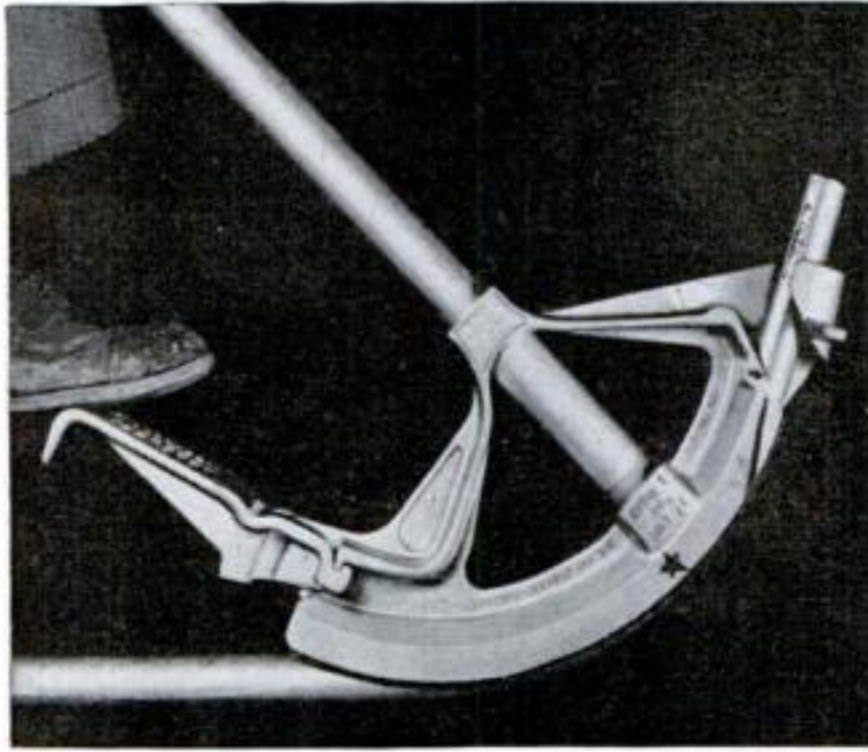
Some saws have tilting guide shoes that can be adjusted for bevel cuts. On the ones with fixed guide shoes, a small block attached to the underside of the shoe will give accurate bevels, although this naturally reduces the depth of cut. Blocks can also be placed on both sides of the blade to control the depth of blind cuts for mortises, lock recesses, and such.

Special attachments are available for most makes. These include bench mounts, radius rods for running off accurate circles of up to 4' diameter, and special guides that clamp to panel stock and adjust for long, straight cuts at any angle.

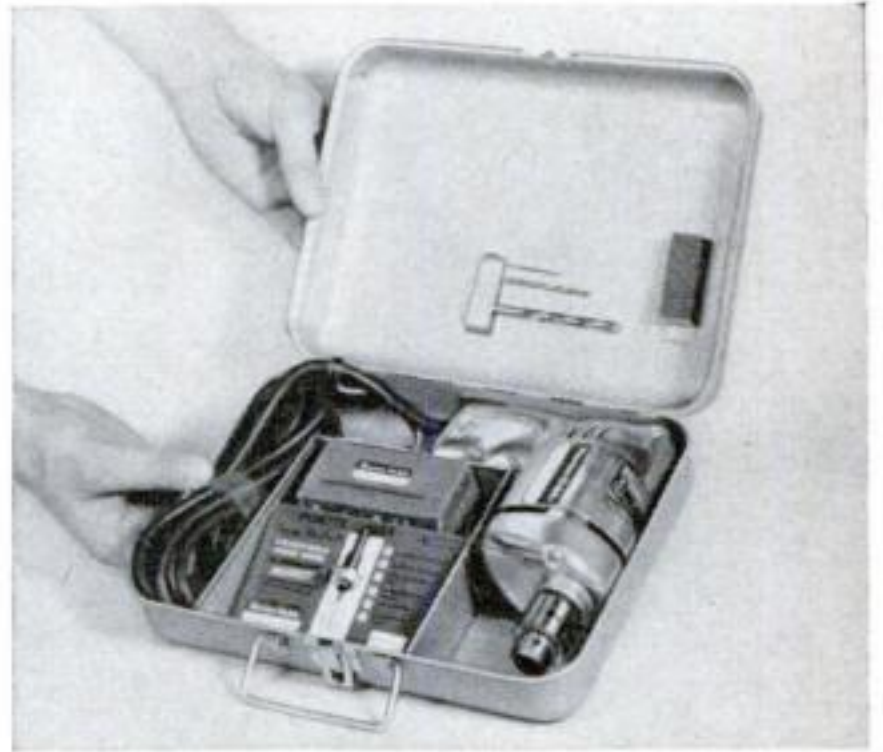
Along with its versatility, the tool is probably the safest of all power saws. Only a small fraction of the blade's length is exposed above the work, and it is deeply recessed behind the leading edge of the guide shoe. Adding to safety and ease of operation, there's no need to brush away guide-line-hiding sawdust as you make a cut. When the power is on, an effective blower in the tool's housing drives a high-velocity stream of air past the blade to clear the path ahead. You can even use this jigsaw blower to clear dust out of hard-to-reach corners or pockets in other shop tools.

Prices range from \$30 for several popular models suited for average jobs in the home workshop, to around \$80 for high-capacity, professional models. **END**

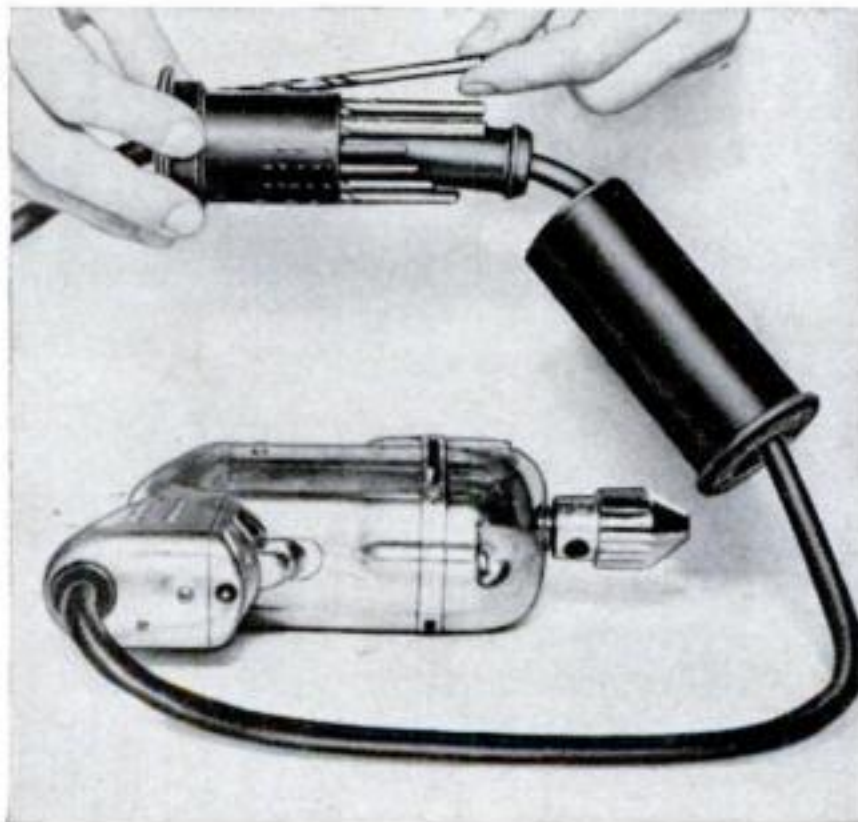
New Tools



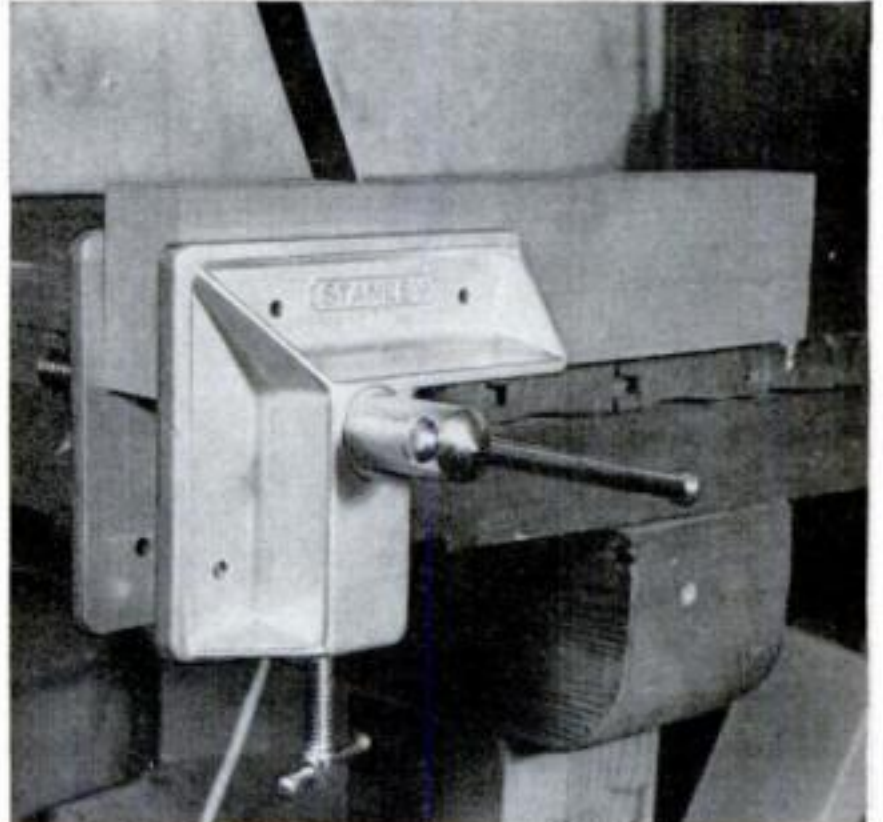
1. Jack Bends Tubing 90°. With this jig and the application of hand and foot power, you can bend 1" rigid steel conduit and 1¼" electrical metallic tubing on a smooth short-radius arc without damage to threads. A marker on the rim indicates the 90° point. Similar jacks for smaller-size tubing are also available.



2. Drill Kit Has Screw Setter. Included in a drill kit are a ¼" electric drill, screw setter, gear-reduction unit, two screwdriver blades, three drill bits. The setter lets you drill for threads and shank, countersink for the screwhead, and counterbore for a plug—in one operation. Its length can be adjusted.



3. Caddy Holds Bits on Drill Cord. Slip this rubber holder on the cord of an electric drill, and you always have a change of bits at hand. The cover goes on over the plug; the core is slit lengthwise for installation. The caddy takes 13 bits and won't spill them when open.

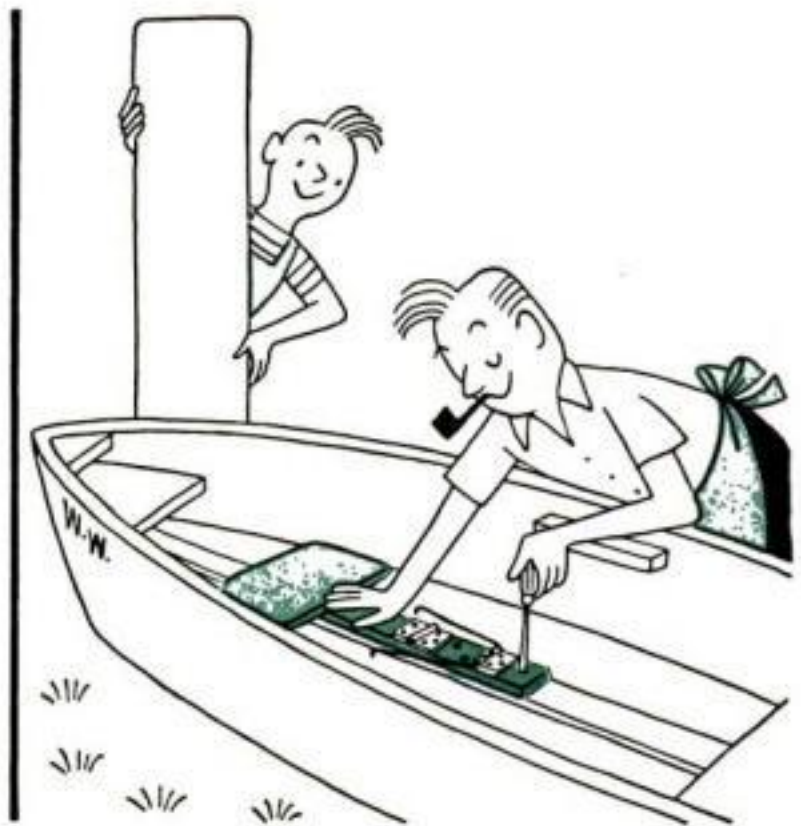
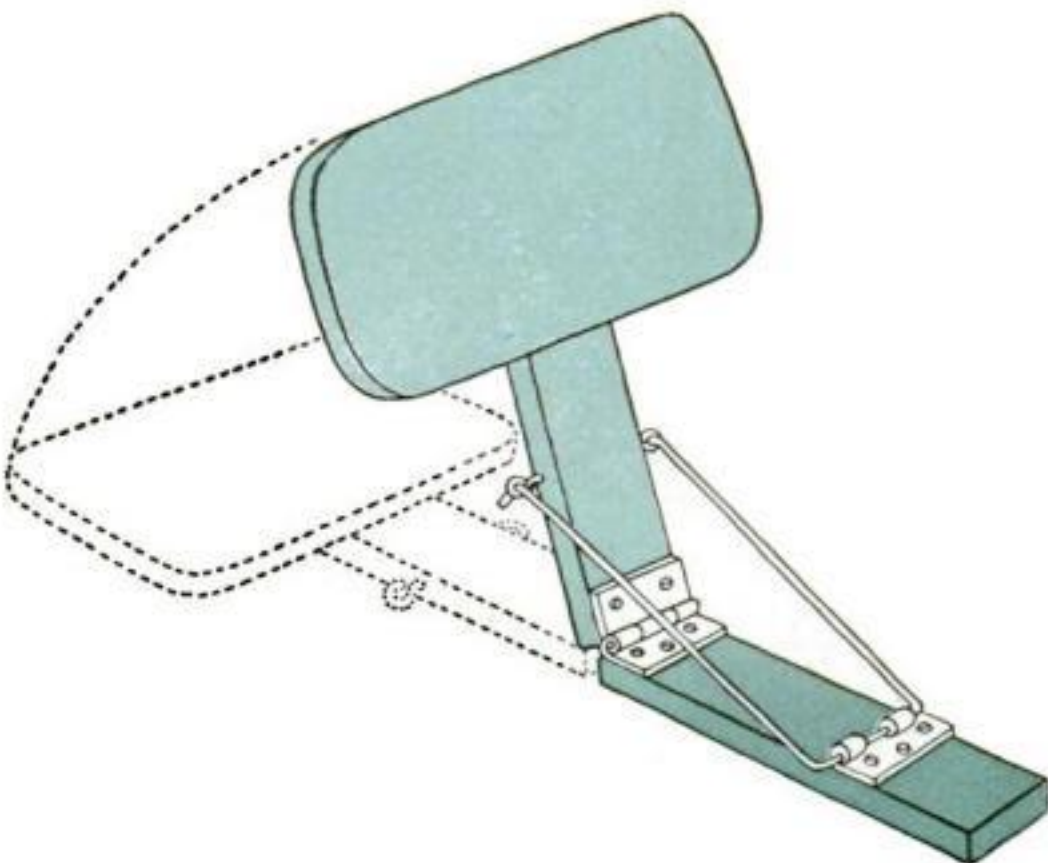
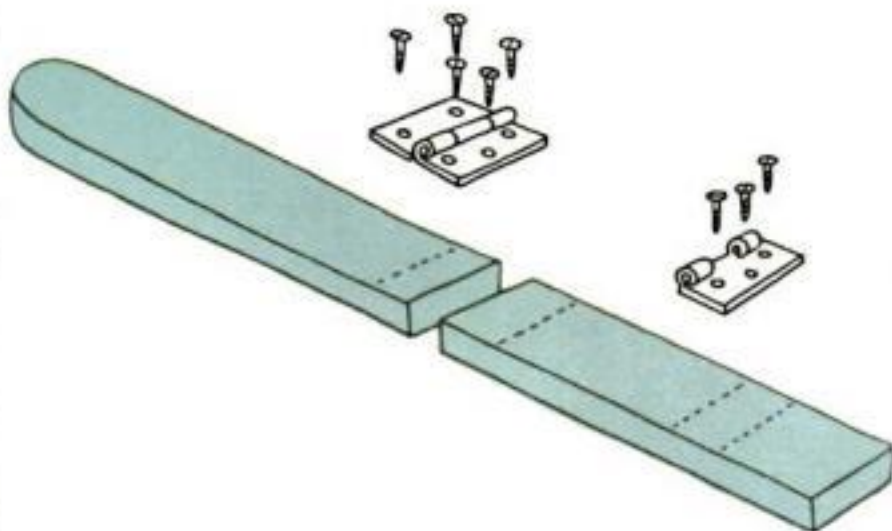


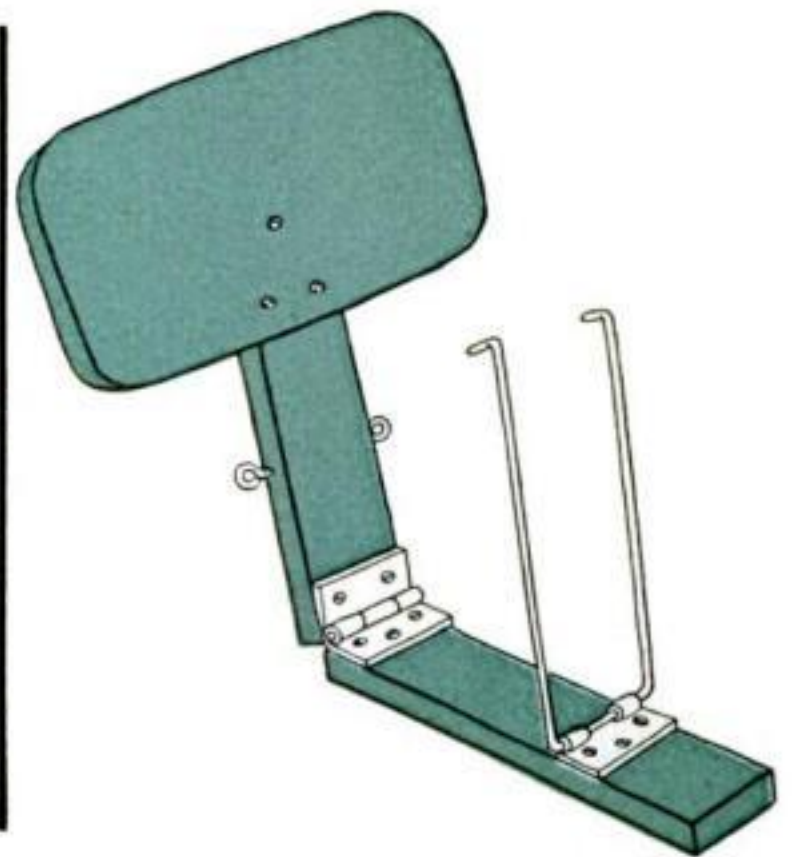
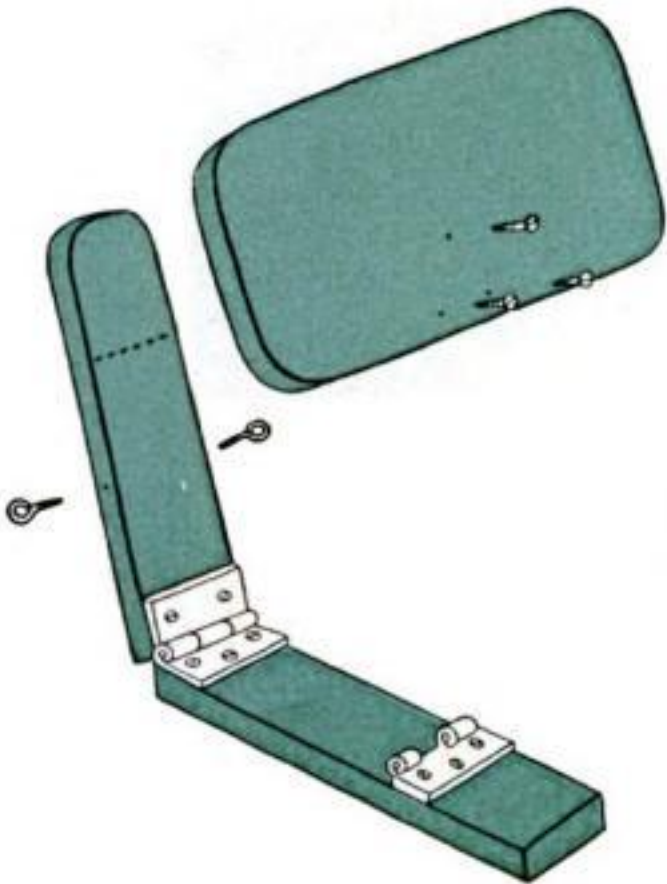
4. Portable Vise Is Aluminum. Besides using this vise on the bench, you can clamp it to any handy projection such as a sawhorse or shelf. Its L-shaped jaws open to 3½" and contain screw holes for attaching cushioning boards. Made of an aluminum alloy, it weighs three pounds.

More information about the new tools shown on this page can be obtained from: 1. National Electric Products Corp., Gateway Center, Pittsburgh; 2. Porter-Cable Machine Co., 1714 N. Salina St., Syracuse 8, N.Y.; 3. Donart Co., 3921 Xerxes So., Minneapolis 10; 4. Stanley Tools Division, 111 Elm St., New Britain, Conn.

Wordless Workshop

By Roy Doty
and Norm Jacky





Next Month: A reel to store a garden hose neatly

JUNE 1957 175

The Right Way to Set a Fence Post

By William B. Eagan

THE weak link in any fence is the post that was set incorrectly. Frost may heave it loose. The mere weight of the fence may pull it askew. The base may rot through before its time.

Doing the job right begins with selecting posts of such long-lasting woods as redwood, cypress, red cedar and locust—or posts that have been pressure-impregnated with preservative.

Fence layout. If a complete fence is involved, locate the end or corner posts first and dig holes to a depth not less than half the fence height. Make the diameter of each hole three times the thickness of the butt of the post.

Drive two stakes into the ground: inside the fence line, at right angles to the corner holes, and at least three feet away. Nail temporary braces to the stakes, set the post in the hole, plumb it in one

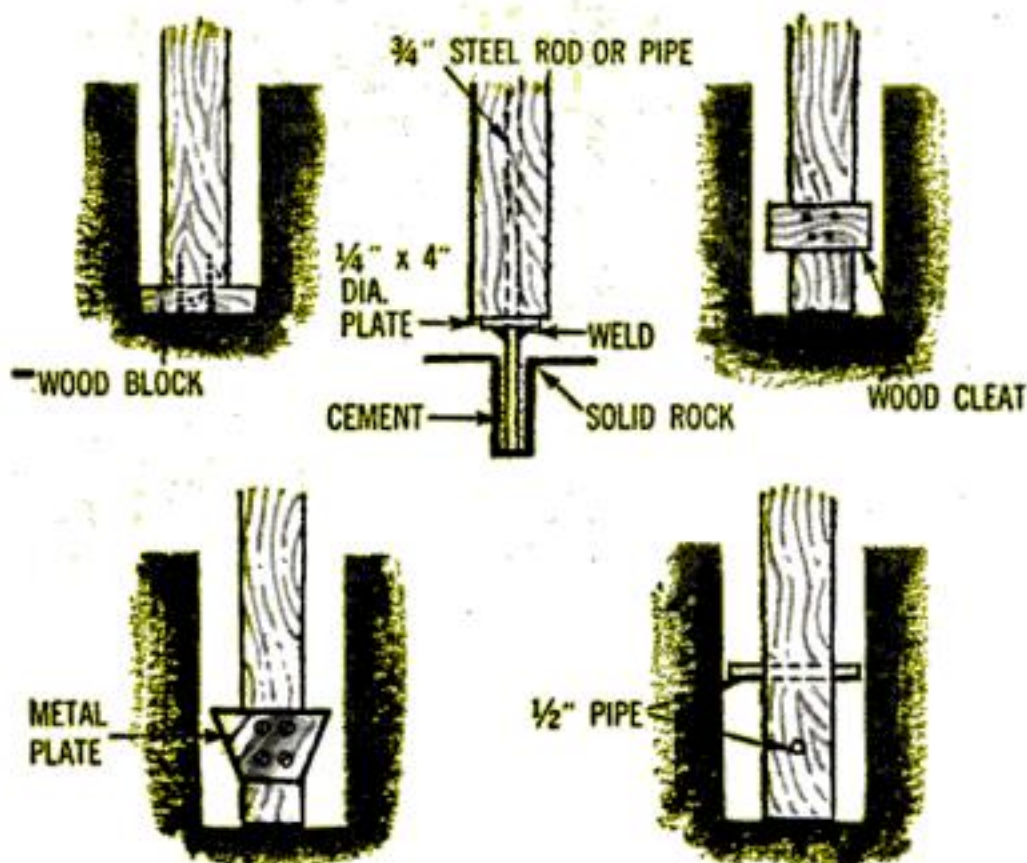
direction with a carpenter's level (Fig. 1); nail the corresponding temporary brace to the post, and repeat the operation to plumb the post in the direction of the other stake. Nail horizontal braces to the post before filling the hole. Leave this bracing in place until the fence has been completed.

Stretch a string between the corner posts to align the intermediate posts. If there is to be a gate, locate posts for this and then spot line posts.

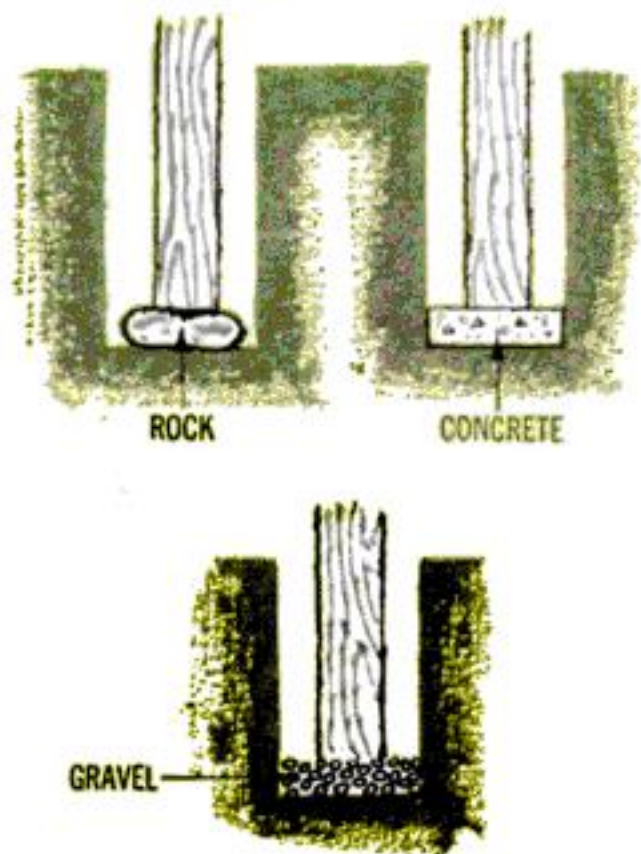
To locate intermediate posts so they will be in a straight line, drop a plumb bob from the stretched cord. Then project this point back inside the line half the thickness of the post (Fig. 1). This is the centerline for the hole.

Anchors. Crosswise anchors on the base of the post (Fig. 2) help to prevent frost heaving. If solid rock is encountered, a post can be mounted on a steel pin. Make a hole in the rock with a star

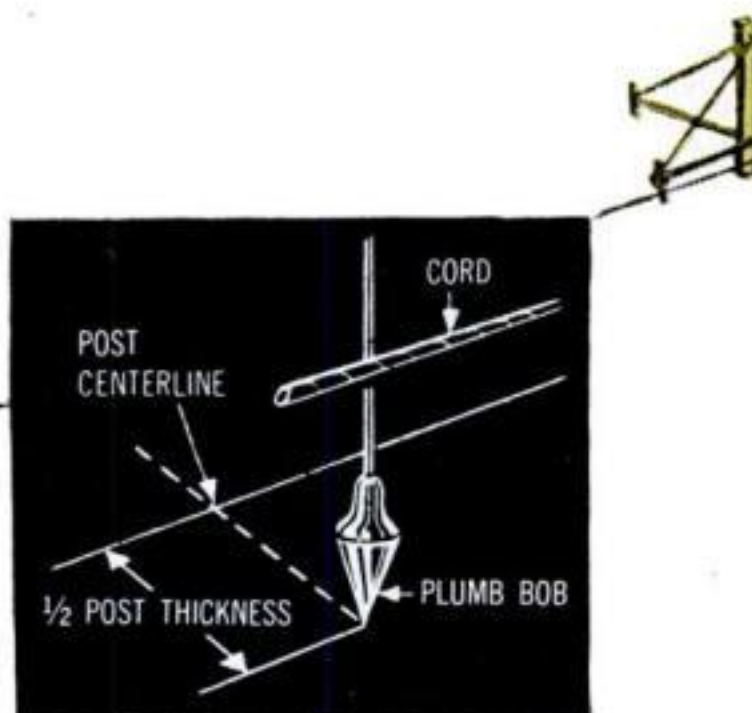
2 Five ways to anchor a post



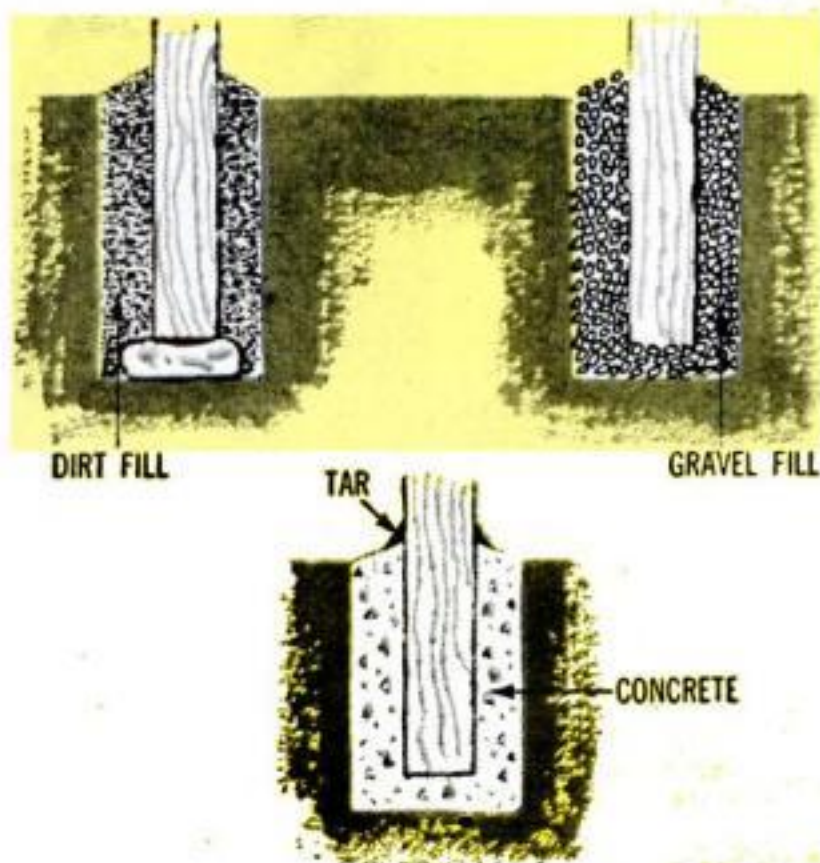
3 Three types of bases



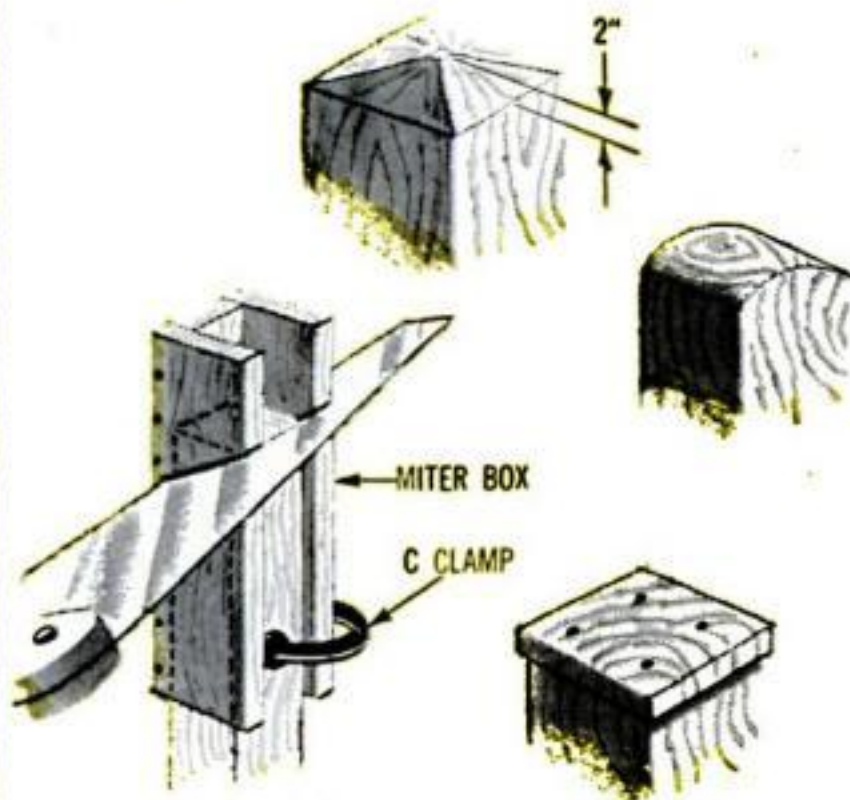
1 Lining up the posts



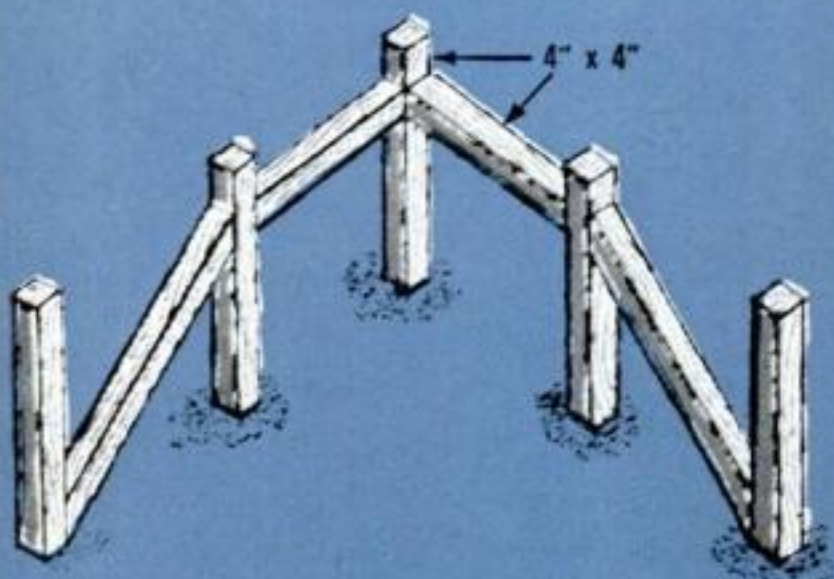
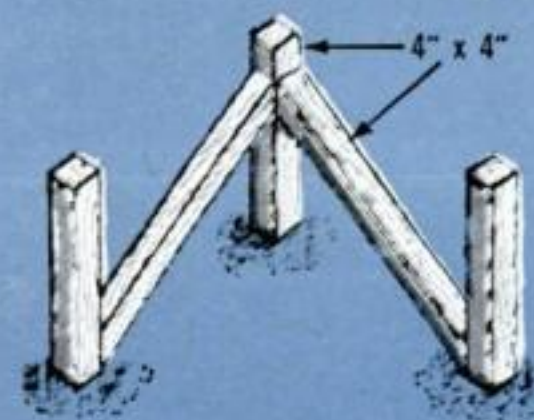
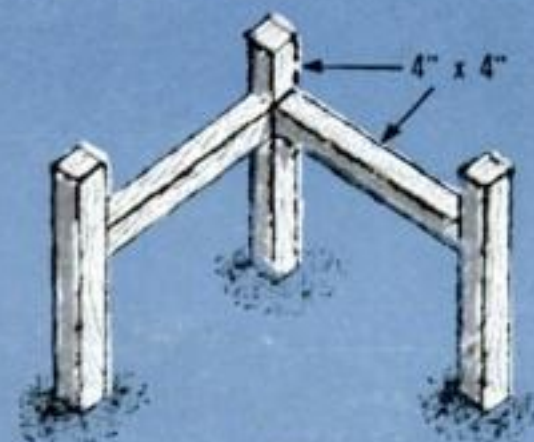
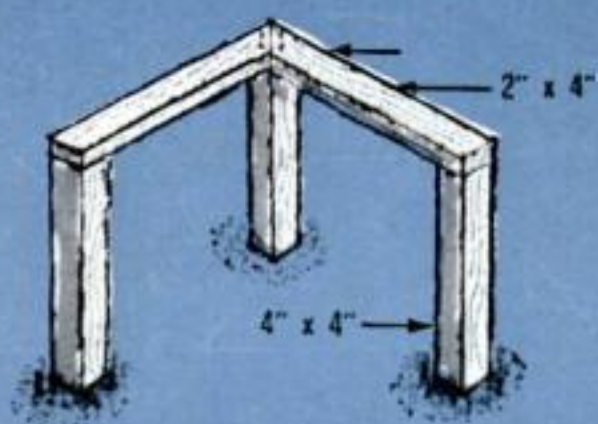
4 Filling the hole



5 Topping the post



6 Bracing corner posts



drill and a hole up into the base of the post with an auger. Size the hole in the post so that the pin is a press fit. Anchor it in the rock with cement.

Bases. Besides using anchors, expert fence builders usually put down a base (Fig. 3) in the bottom of each hole—a flat stone, a layer of concrete, gravel or crushed stone—before setting posts.

Backfill. Dirt removed from the hole makes satisfactory backfill (Fig. 4) where the soil is dry most of the time. In wet or poorly drained soil, however, it is better to fill the hole with gravel or crushed stone so that water can drain away from the post. Concrete is frequently used as a fill, too, but the experts contend that concrete is apt to retain moisture, causing the posts to rot. This tendency can be reduced by applying a seal of heavy tar around the joint between concrete and post above ground level.

For a solid post, tamp the fill, as it is being shoveled into the hole, with a crowbar or tamper. To get maximum compression of dirt or gravel, dampen each layer slightly before tamping.

Topping the posts. This is done to improve the appearance, to improve drainage—or both (Fig. 5). Some types of topping should be done before the posts are put into the ground. Others, like the angled cuts made with a miter box, can be done afterwards. A 30-degree angle is sufficient for good drainage.

Braces. Because of the two-directional pull, a corner post should always be braced (Fig. 6). Braces can be fastened to the posts by toenailing or with metal brackets.

END

Attention Chevy Owners!

A shop-manual article devoted exclusively to the '57 Chevy will appear in the July issue of POPULAR SCIENCE. It'll give you the same kind of practical, hard-to-find information that '57 Ford owners are receiving this month. Watch for it!

A Plymouth report will come later.

**A practical manual
for Saturday mechanics:**

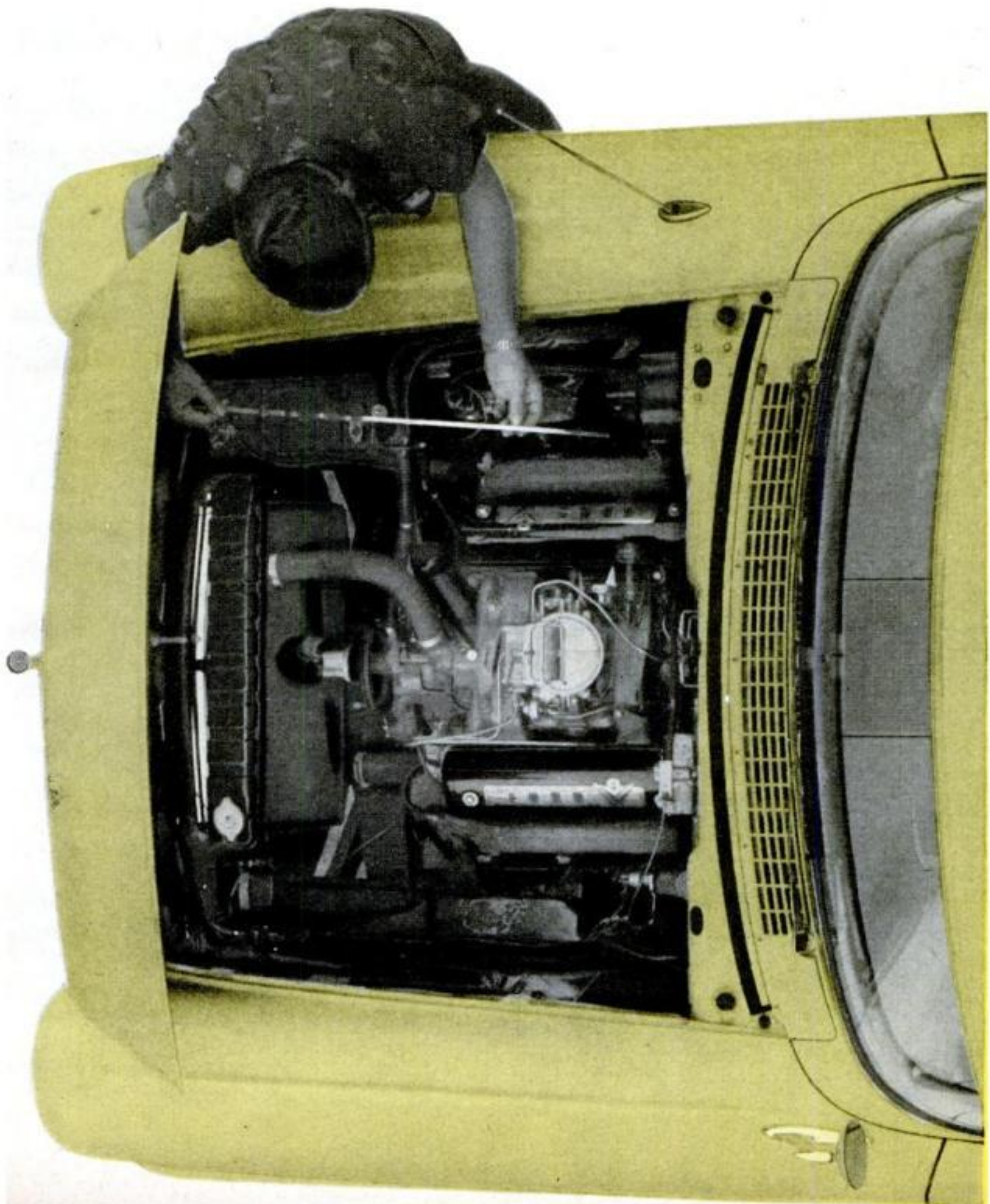
How to Take Care of a '57 Ford

By William Carroll

NEARLY all variations of the four '57 Ford engines perform well on regular gasoline. Exceptions are the power-packed Specials, which use

premium fuels to deliver maximum performance.

Performance enthusiasts are making hay with the standard engines, however, by resetting the initial advance one or two degrees ahead of normal to take full



**On
the next
6 pages**

**How
to adjust
ignition,
carburetor
lights,
valves,
body
alignment
brakes**

advantage of local high-octane gasolines.

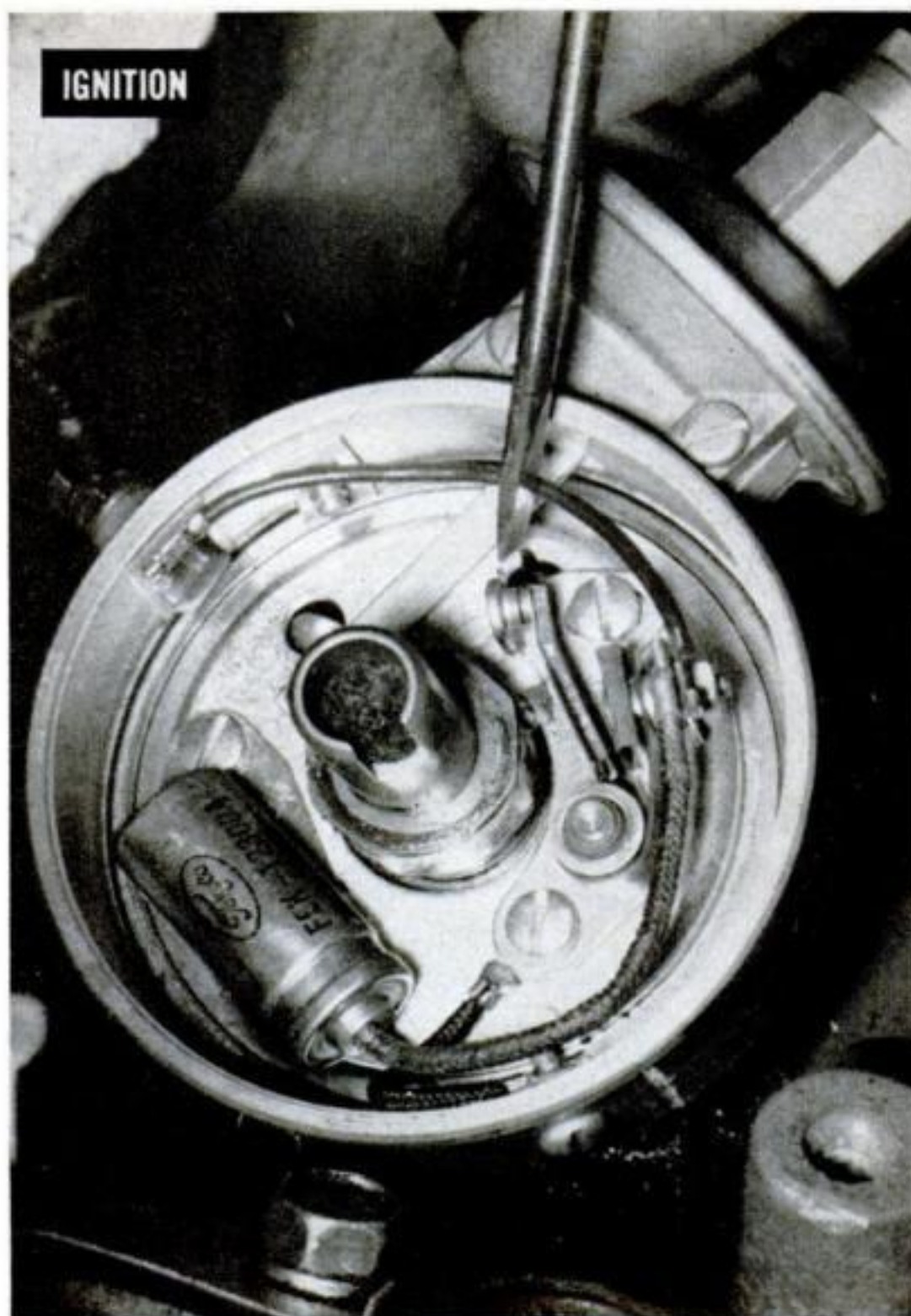
After timing, only two engine adjustments are worth worrying about: fan-belt tension and valve-lash clearances. Belt adjustment is undertaken by loosening the generator clamp and mounting bolts. Pull the generator outward until the proper belt deflection is obtained. Under light thumb pressure, $\frac{1}{2}$ " deflection for V-8's and $\frac{1}{4}$ " for the six is correct. Press on the belt midway between fan and generator pulleys.

Valve clearance (lash) for all Ford engines is .019" hot. A minimum of 30 minutes' engine running is needed to stabilize temperatures. Clearances *can* be adjusted while the engine is idling, but for a precise job and to prevent the feeler from being hammered flatter, a still adjustment of valves following the cylinders' firing order is recommended.

Carburetor adjustment. Each one of the bewildering array of Ford carburetors fitted to Ford production cars offers a choice of jets and metering rods to compensate for altitude variations and transmission options. If you have mileage problems, start here—but with a competent carburetor specialist doing this work.

Before adjusting the idle mixture, the "hot" and "cold" idle speeds should be set. With the parking brake on and the engine warm, back off the choke fast-idle-adjustment screw (the "cold" setting) from the stepped fast-idle cam. Turn the "hot" engine-idle adjustment (the one on the throttle lever with the spring wrapped around it) to obtain a slow idling speed. With Fordomatic transmissions, adjust the idling speed with the selector in Drive (be *sure* the parking brake is set). Go back to the fast-idle screw and turn it in until it just touches the lower step on the choke-controlled fast-idle cam, then back it off one-quarter turn. Finally, the idle mixture can be adjusted by turning the idle-mixture needles.

Ford air cleaners are the replaceable paper-element type which can be cleaned every 2,000 to 4,000 miles by tapping them against the palm of your hand. Unscrew the wing nut on the top of the air

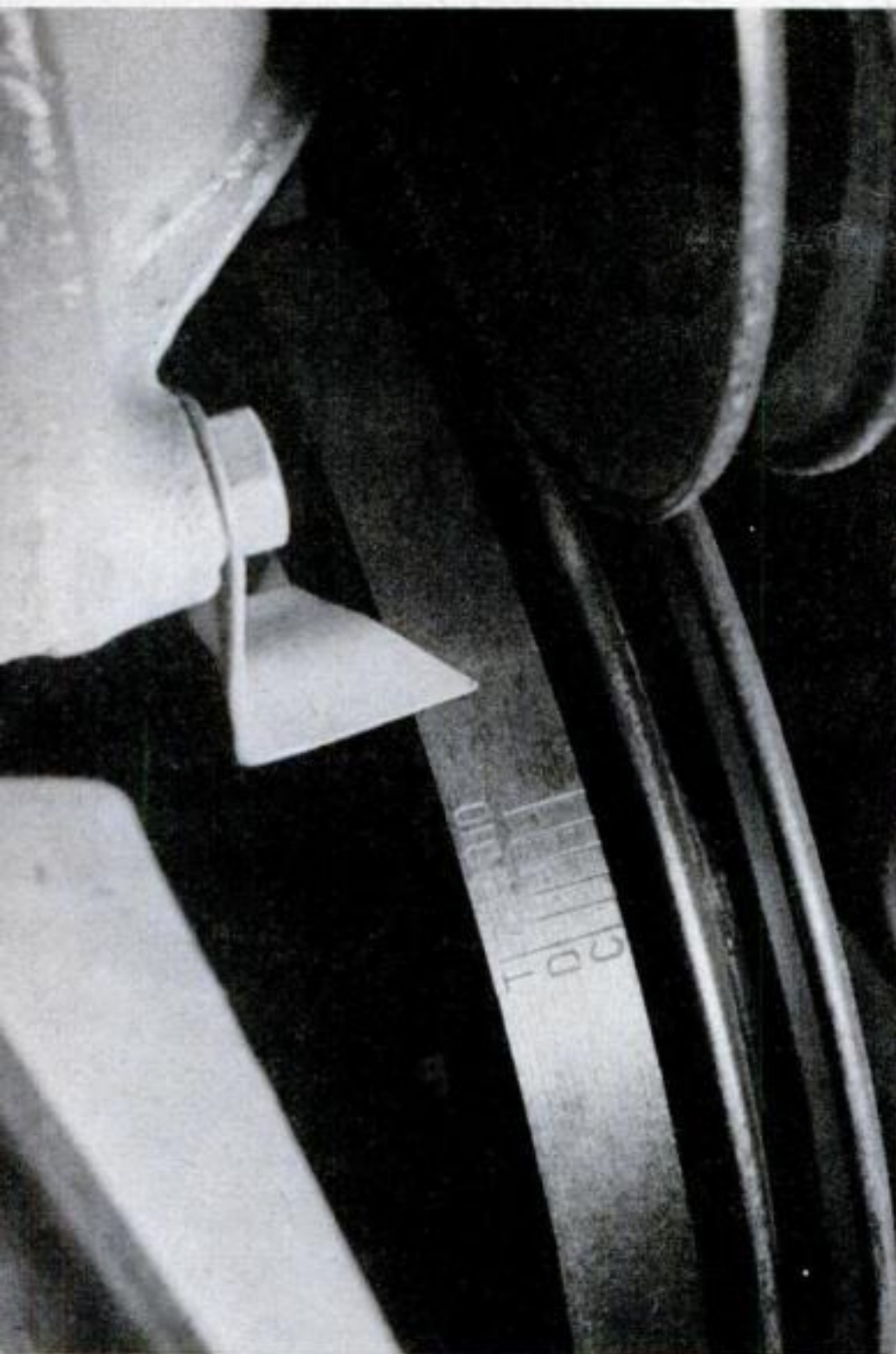


TO GAP POINTS, crank engine until they open. Loosen lock screw near contacts and shift stationary point (on left) slightly to change gap. When a setting of .014" to .016" on V-8 or .024" to .026" on the six is obtained, tighten the lock screw and recheck the gap.

cleaner and lift off the cover to gain access to the filter element. Do not use air pressure or rinse in any liquid when cleaning. This ruins the filtering action. At 20,000 miles put in a new element.

Every 4,000 miles (sooner, if you drive dusty roads) soak the oil-filter cap in solvent to clean the steel-wool insert. Shake the solvent out and oil lightly with SAE 10 oil before replacing.

The welded-steel Ford body should stay in alignment for the car's life; but doors, deck or hood may shift and eventually squeak against adjacent metal. Adjustment is easy, as all door hinges cover elongated holes where hinges attach to body pillars. Fore-and-aft movement of the doors requires removal of interior

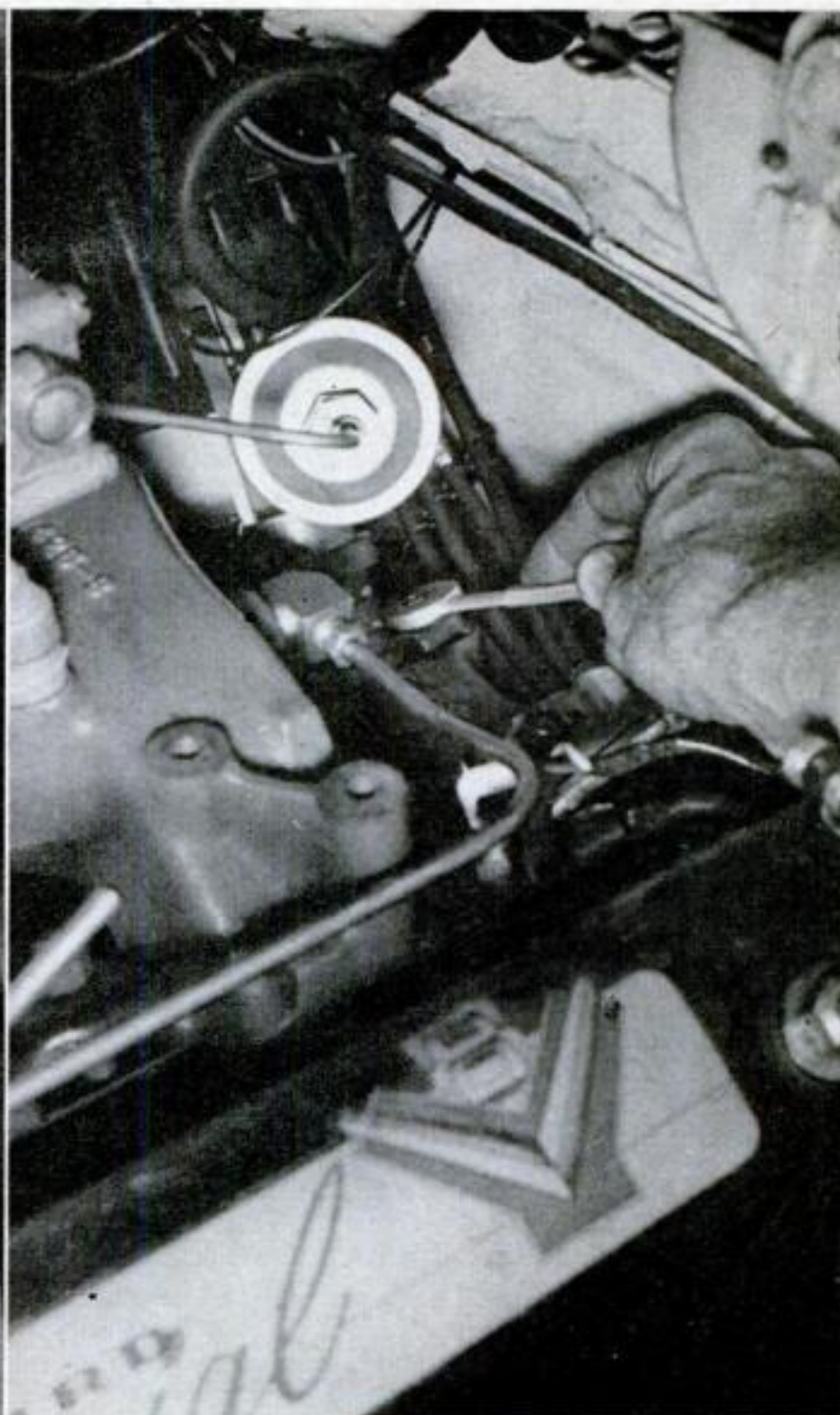


TIMING MARKS are on the harmonic balancer at lower front of engine. Each mark is 2° before top dead center on V-8. On the six, each mark represents 3° , 5° , 7° and 9° before TDC. Timing can be set with an inexpensive neon timing light hooked to the No. 1 plug.

trim to reach door-to-hinge bolts. Deck and hood hinges also have elongated holes for necessary adjustments. In every case, the lock striker plate should be removed before adjusting the closure; when alignment is obtained, the striker plates are reinstalled to suit.

Ford's baked-enamel paint job requires little polishing if washing is frequent and thorough. You could find yourself polishing base metal if you try cleaning chrome with abrasives or steel wool. A good grade chrome cleaner is best. Don't polish the tail-light frames. They're made of plated plastic and need only washing to stay bright and cheerful.

There is little any car owner should do to his steering gear. If the car has

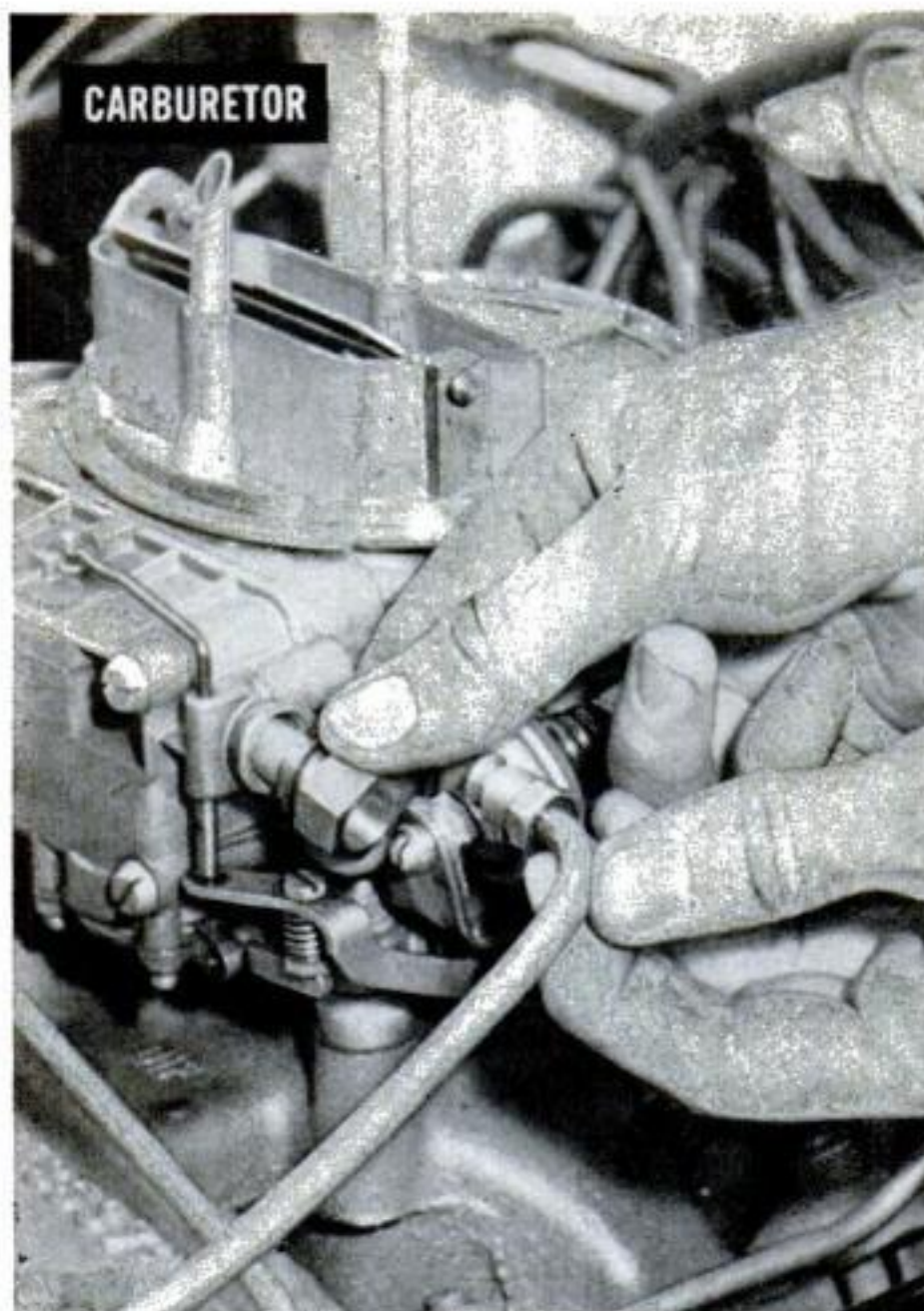


LOOSEN CLAMP BOLT and rotate the distributor while aiming the timing light at degree marks. With the engine idling, set V-8 at 3° for manual transmission— 6° for Fordomatic. Set the six at 4° or 6° . Recheck the timing after tightening the distributor clamp bolt.

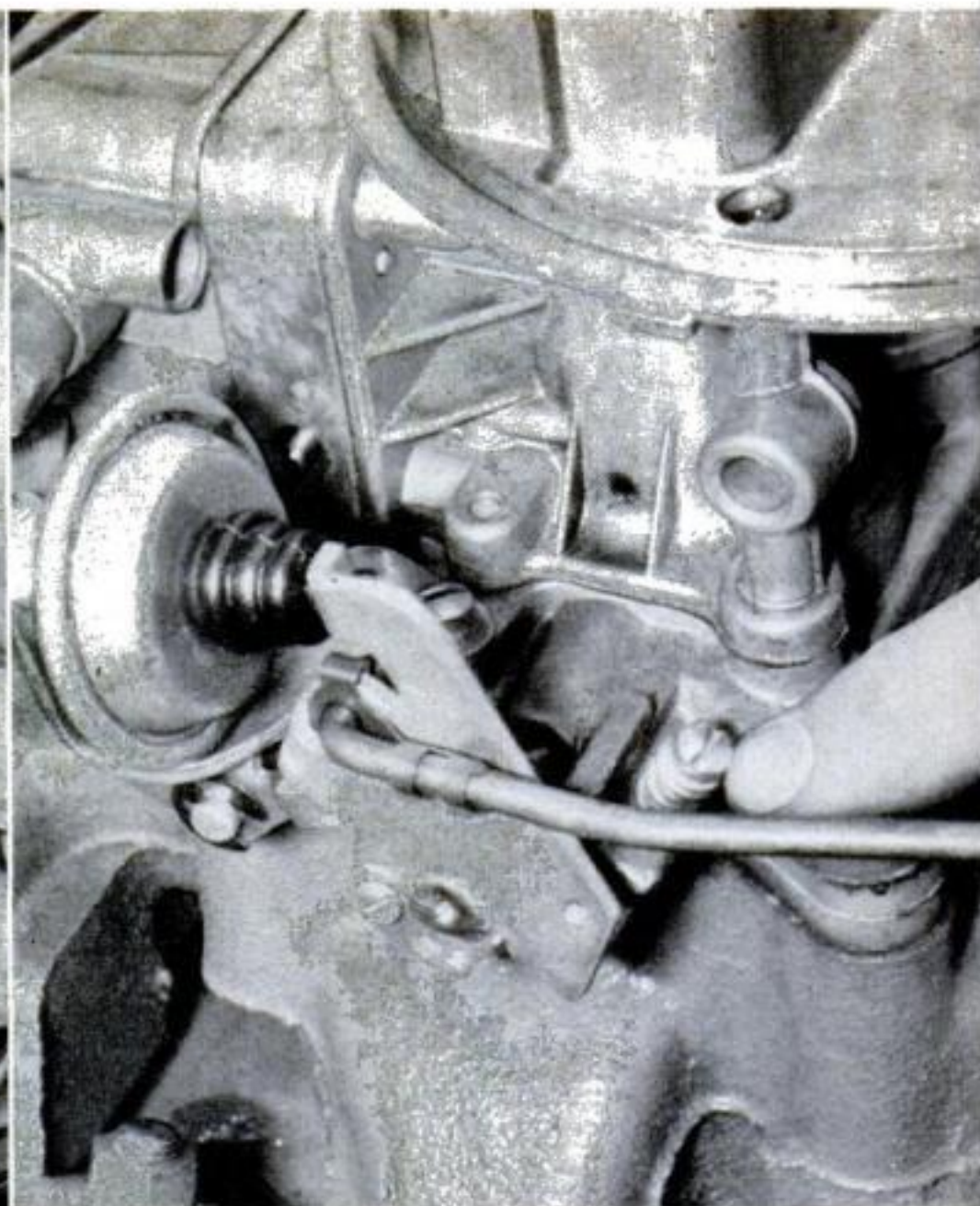
power steering, check the fluid in the pump reservoir every 1,000 miles. Remove the cap and check the dipstick. Add only enough type A automatic-transmission fluid to raise the level to the full mark.

Transmission. Check the fluid level in the Fordomatic transmission every 1,000 miles. But before you check, drive the car at least 30 minutes. With the selector at "P" and the engine idling, the fluid should be at the FULL mark on the dipstick, which is located at the rear of the engine on the right side. Add, if needed, only enough type A automatic-transmission fluid to reach the mark.

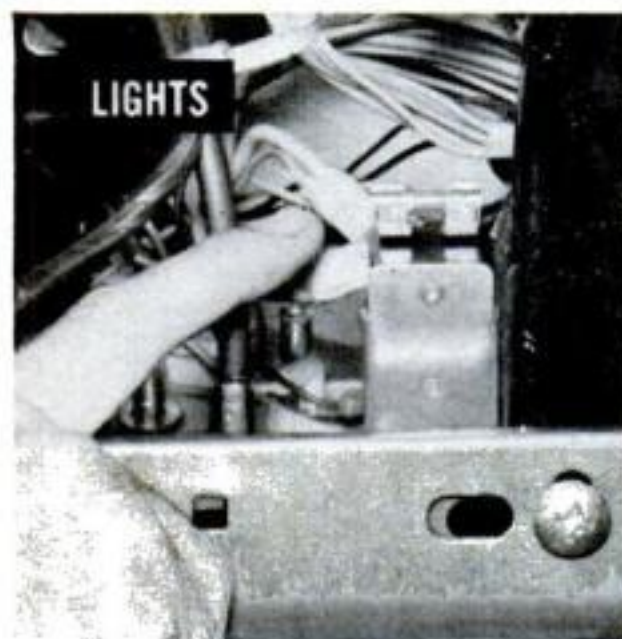
Engine oil and the oil filter should be changed every 4,000 miles. Drain the



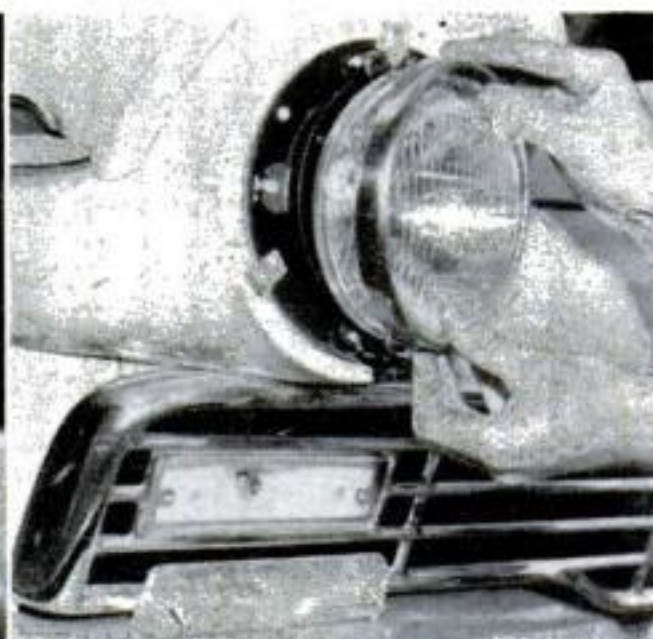
ALL V-8 CARBURETORS HAVE A FILTER at the fuel-inlet fitting. It should be cleaned to remove the scale and sediment it collects before the carburetor is adjusted or the engine tuned. Disconnect the fuel line first, then remove the filter and soak it in solvent. All Fords have a filter at the fuel pump. This filter, too, should be removed and cleaned periodically.



IDLE-SPEED ADJUSTING SCREW (at fingertip) is located on the throttle lever. Surrounded by a coil spring to maintain tension, it is easy to identify on all carburetors. If you don't have access to a tachometer, adjust the screw to obtain the slowest idling speed possible with the transmission in Drive. Caution: Be sure that the handbrake is *fully set* before you work.



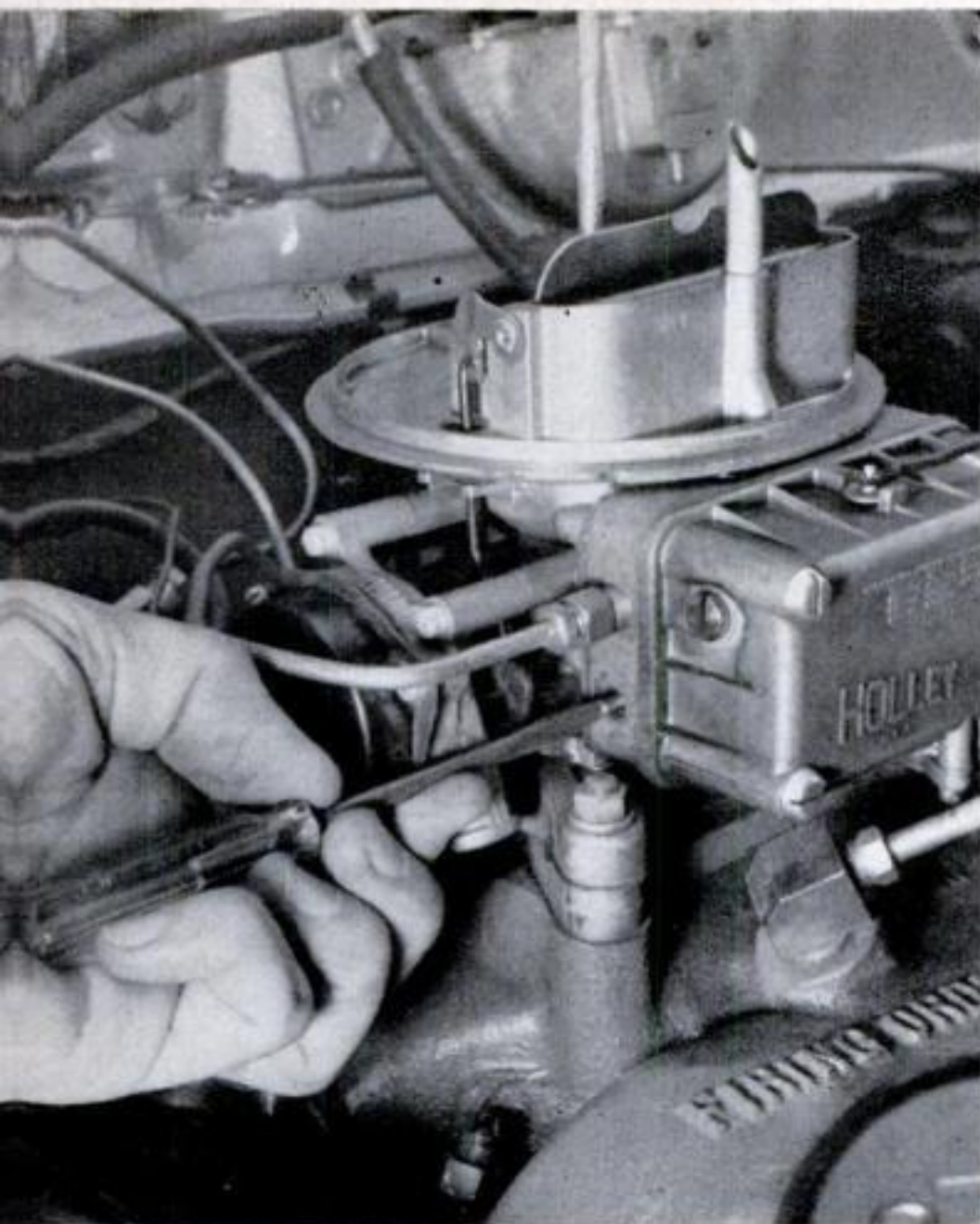
THIS 7½-AMPERE FUSE mounted on the back of the headlight switch protects the dome, map and courtesy-light circuit. Also a part of the headlight switch are two circuit breakers. One protects the headlights, while the other protects the instrument, parking, stop and tail lights. The headlight switch and circuit breakers must be serviced as an assembly unit.



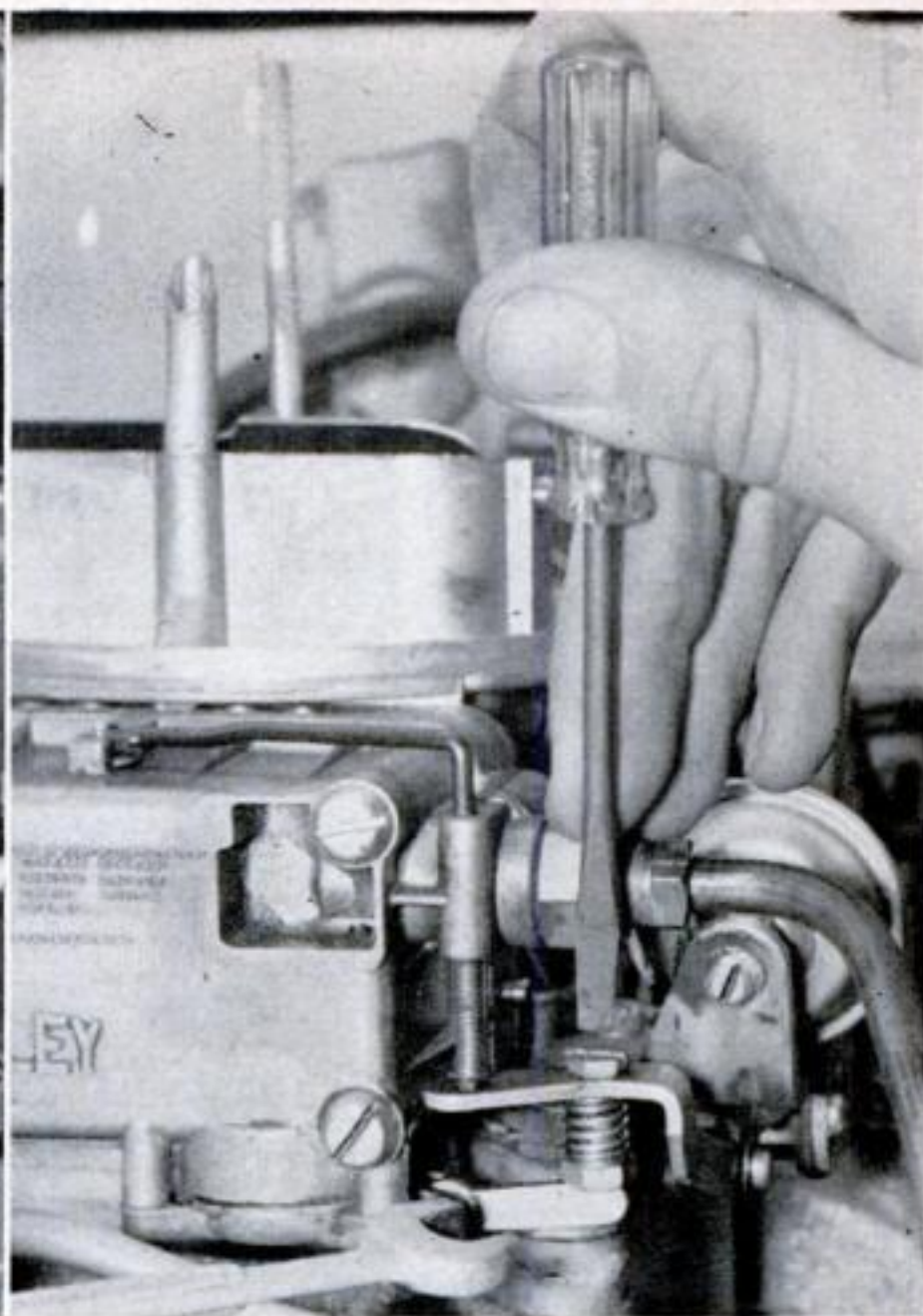
WHEN CHANGING A HEADLAMP, remove the trim ring, then loosen only those screws passing through the chromed retaining ring (the larger screws beside them are for aiming the lights). Twist ring slightly to left and slip it off over the screw heads. The bulb plugs into a three-pronged female connector. To replace the parking bulb, simply take off the protective lens.



REAR LIGHT BULBS are replaced by removing four screws around the lens assembly. Be careful when replacing the screws as the "chromed" ring and red lens are plastic and may be cracked if too much enthusiasm is applied. Be careful to replace the lens with the "top" mark up. There's a drain hole to carry off excess moisture that sometimes condenses inside the lens.



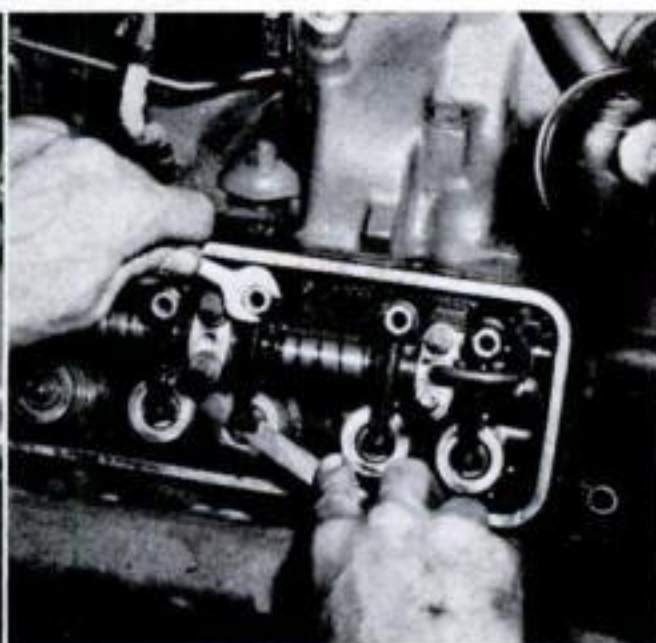
LOCATION OF IDLE-MIXTURE NEEDLES varies. On the Holley carb shown here, there's one on each side. Carter and Ford carbs have them side by side at the base. In any case, with the engine warm, turn them in *equally* until the engine skips. Then turn them back out until it rolls. Finally, turn them in slowly until the engine runs smoothly on the rich side.



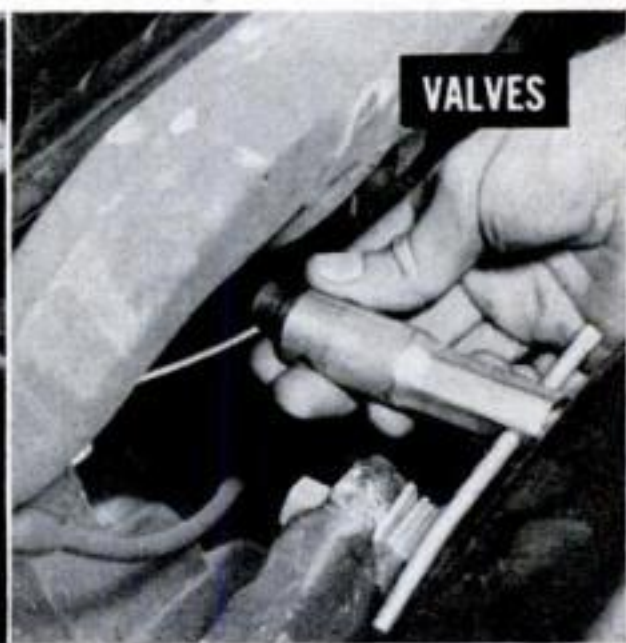
ACCELERATOR-PUMP STROKE requires .015" clearance between the adjusting screw and the pump arm when the arm, which pivots at the base of the float bowl, is depressed to its limit of travel. Depress the arm manually, turn the screw so that it touches the pump arm, then back it off one-half turn for adequate clearance. Only Holleys require this adjustment.



TO SET VALVES, remove the rocker-arm cover. Make chalk marks on the distributor body beneath each cap terminal and number them by tracing the plug wires. On the V-8 they'll read 1-5-4-8-6-3-7-2 counter-clockwise; on the six, 1-5-3-6-2-4 clockwise. Remove cap and crank engine until rotor stops at No. 1 mark. Now set both valves on No. 1 (front, right).



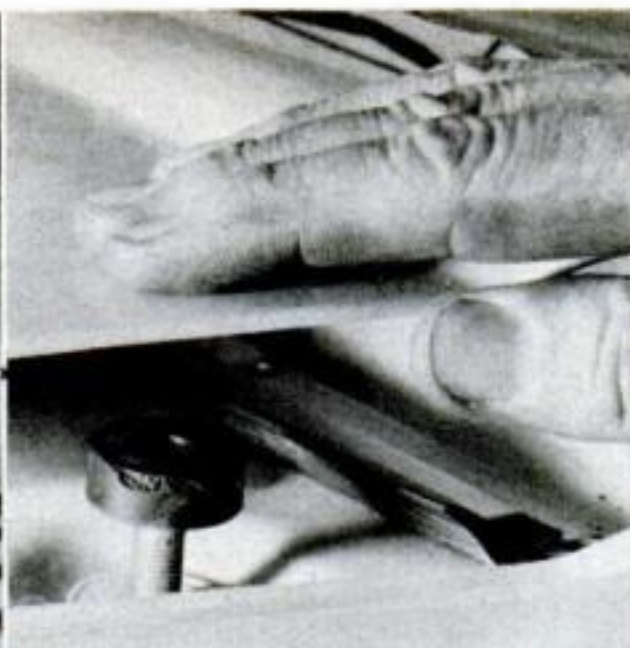
SELF-LOCKING BOLTS are found on the rocker arms of the '57 Ford instead of usual screw and lock nut. With engine hot, pull hard with a wrench to adjust bolt for .019" clearance between rocker arm and valve stem. Crank engine lightly until rotor moves to next chalk mark, where both No. 5 (front left on V-8) valves can be set. Continue until all valves are adjusted.



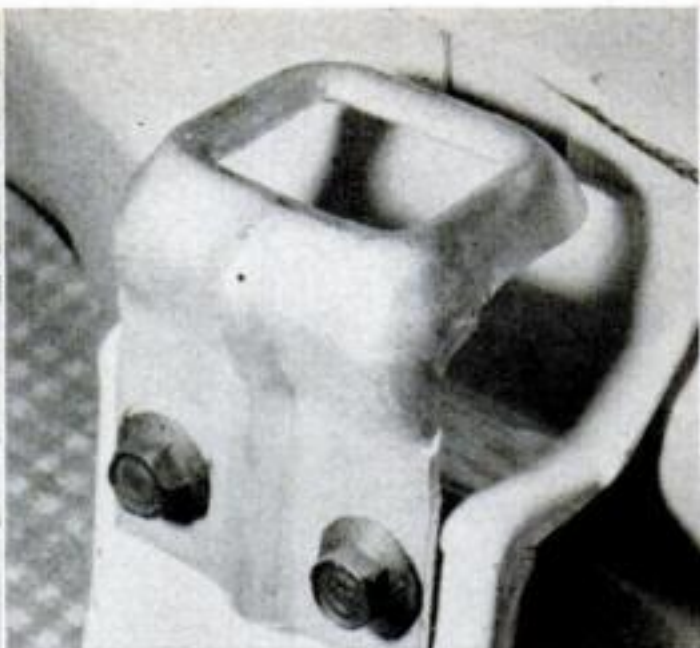
WHEN SETTING VALVES, it is sometimes difficult to stop cranking the engine exactly on the firing stroke (chalk mark). By removing all spark plugs to relieve compression, you can turn the engine over slowly by pulling on the fan. Use an inexpensive T-handle plug wrench and avoid overtightening. Ford uses Champion No. 870 gasketless plugs gapped at .032" to .036".



THE HOOD can be adjusted by loosening these two bolts in the hinge bracket on each side. Elongated holes permit almost an inch of adjustment forward or backward as needed. Holes for mounting-bolts on door hinges, fenders and deck lid are similarly elongated and all body parts can be aligned by loosening the bolts a little and carefully shifting the sheet metal.



NEW FRONT HINGING on the '57 Ford requires stops to support the hood flush with the cowl when it is closed. An adjustable rubber cushion at each rear corner can be screwed down or backed off to support the hood at the proper height. If necessary, the latch can be reset to make the center of the hood match the contour line of the cowl more perfectly.



A RATTLING TRUNK LID, or one that won't close easily, calls for adjustment of the latch plate. Pencil a reference line around the plate so you can shift it to a new position with accuracy. Then loosen the two holding bolts and tap the plate lightly to move it. Tighten the bolts before closing the lid to try it for fit. It should lock with only a slight hand pressure.

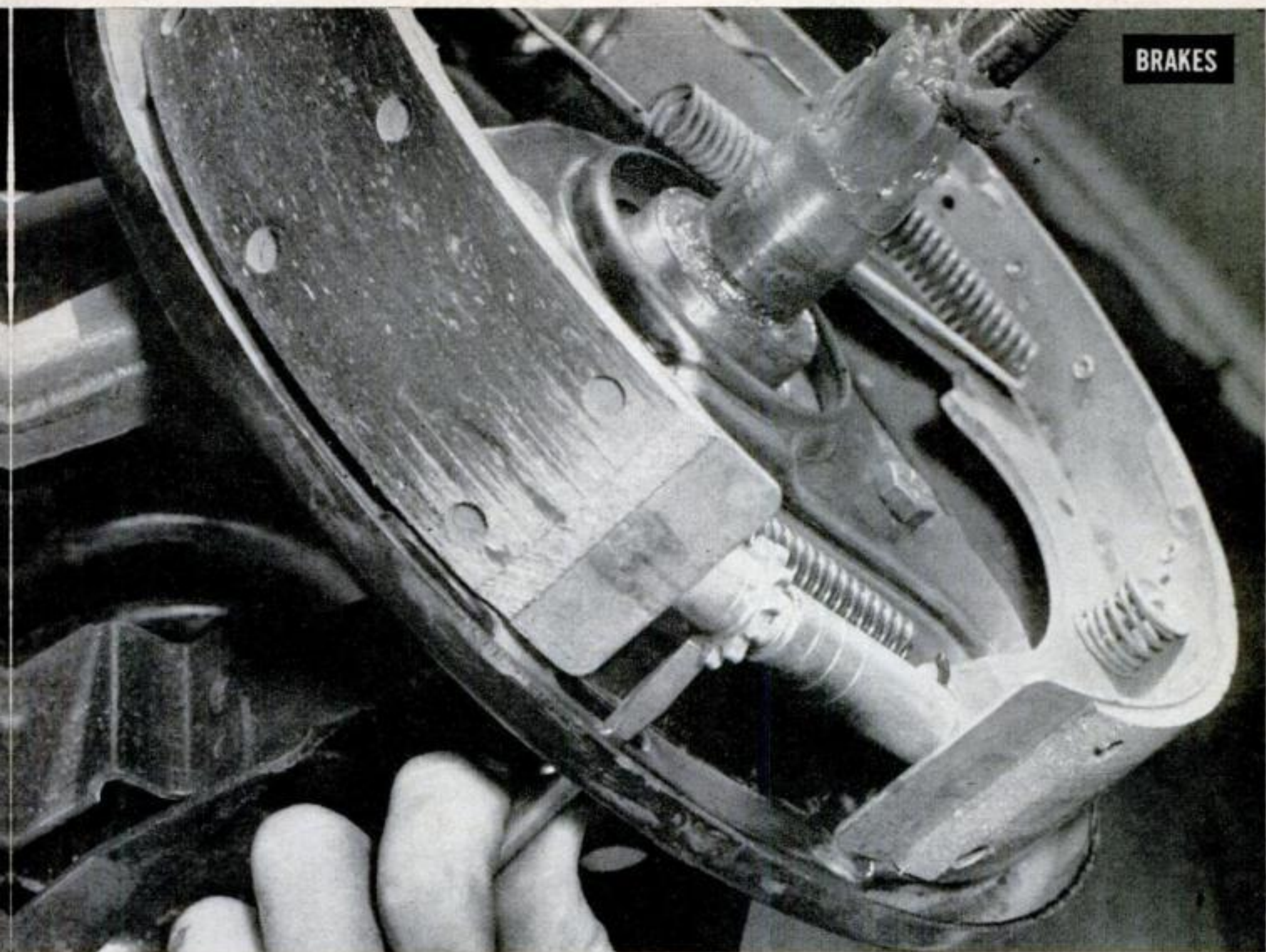
crankcase immediately after the engine has been well warmed and the oil stirred up by a half-hour or more of driving. Changing the filter is a messy job, but not impossible. Place a pan under the filter and unscrew the entire can (like a mason jar) from the engine block. Clean the block fitting, coat the new gasket with oil and screw the new filter (Ford part #B2A 6731) in place. Hand-tighten the filter until the gasket touches the adapter face, then twist it a full quarter-turn more. Pour five quarts of oil into the crankcase, operate the engine for a few minutes at fast idle to check for oil leaks at the filter, then add oil to bring the level to FULL. Use motor oils designated "MS" for all driving conditions. If "MS" oils aren't available, "MM" oils can be used. Engine oils marked "ML" are not recommended for Ford engines.

Radiator care includes using a good rust inhibitor and leaving the cold-water level just below the bottom of the filler neck to allow room for heat expansion. To empty the cooling system, open a drain cock on the bottom of the radiator. Drain the block by opening two additional cocks on the V-8 (one on each side below the spark plugs), or a single cock at the left rear of the six engine.

Every 1,000 miles, fill an oil can with SAE 10 engine oil and go over the car. Apply it sparingly to hinges, latches, linkages and other mechanical connections. Wipe off excess oil to prevent the accumulation of greasy dirt. Every 5,000 miles, put a few drops in the generator oil cup and the felt wick in the center of the distributor shaft (beneath the rotor). Don't oil the breaker cam as oil will throw off to the points, causing arcing and premature failure. Instead, a light film of high-temperature grease should be applied whenever new points are installed.

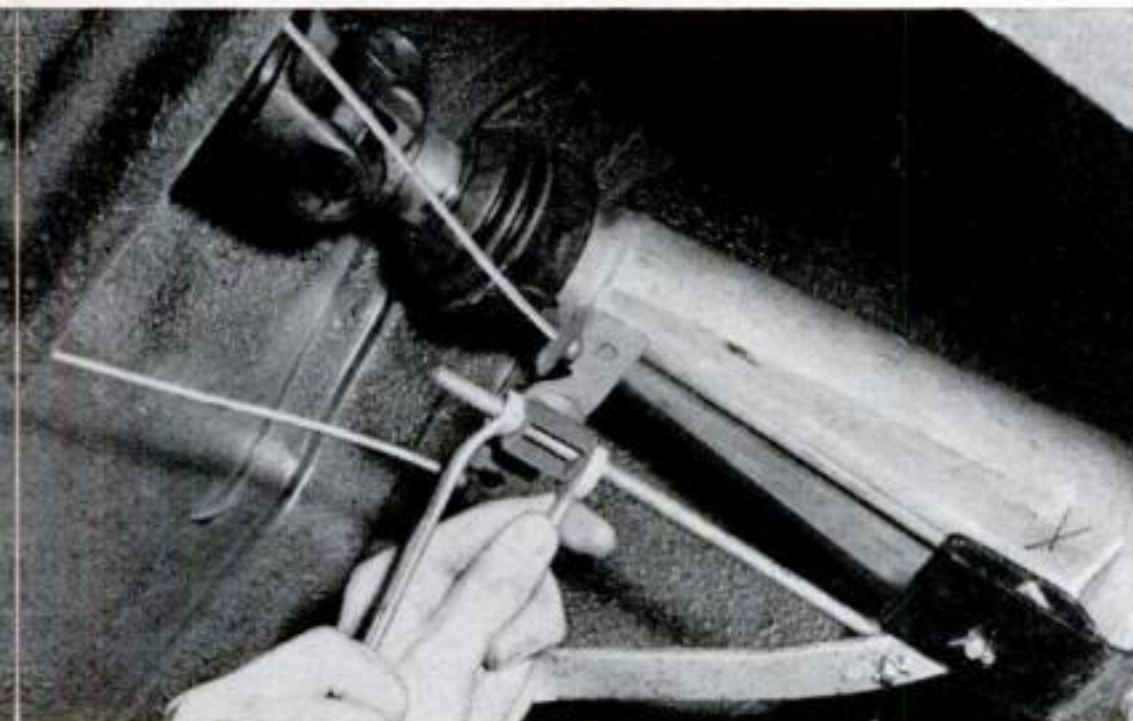
Tighten all clamps in the exhaust system every six months or so to eliminate rattles and exhaust fumes. Hidden at the end of the exhaust pipe is the manifold heat valve. Place a few drops of graphited kerosene on its shaft every 1,000 miles to keep it free. If it sticks, free it by tapping the shaft ends with a hammer until the counterweight moves easily.

With a few good tools, these instructions and those in the owner's manual, '57 Ford drivers need spend only an occasional morning off to keep their cars in tip-top condition—and save many a dollar in routine maintenance costs. **END**

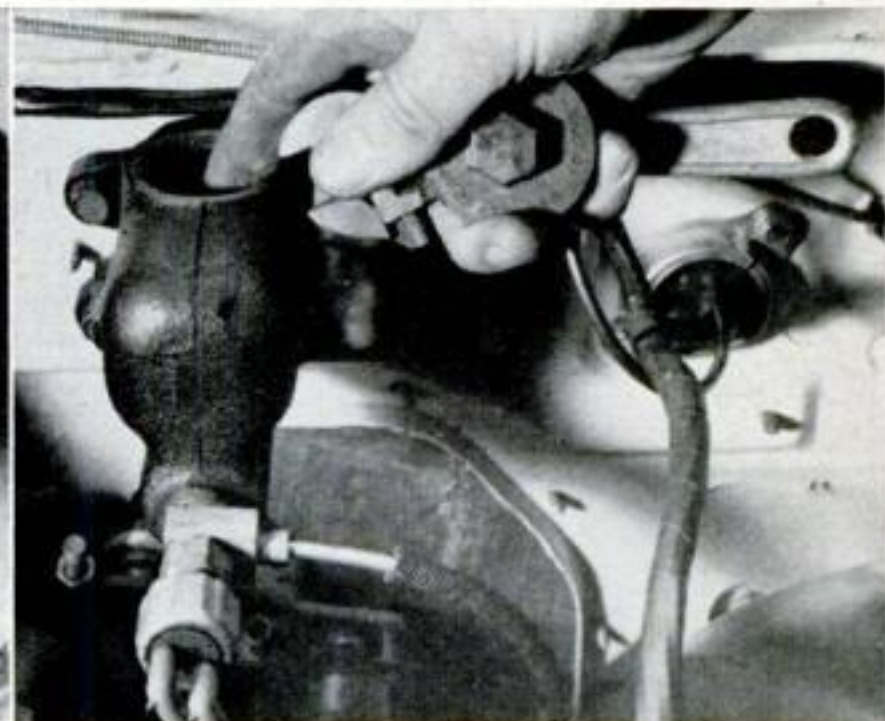


BRAKE ADJUSTMENT hasn't changed—is the same for regular or power brakes. Jack up each wheel and pry off the cover from the adjusting slot. Reach in with a screwdriver and turn

notched adjusting wheel (drum is removed here to show star wheel) until brake shoes drag. Then back off adjustment wheel until the drum rotates without drag. Replace slot cover.

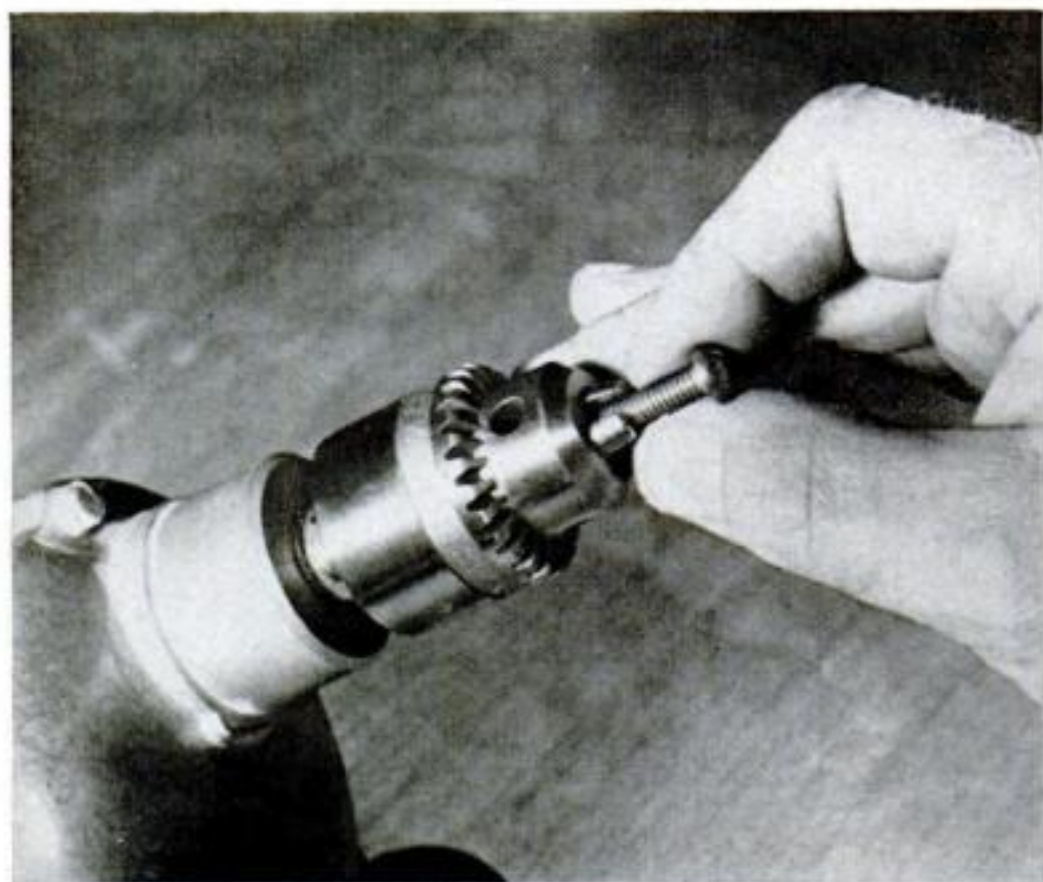


PARKING BRAKES usually snug up when the service brakes are adjusted. But they sometimes require a separate adjustment. Loosen the nut in front of the equalizer and back it off several turns, then turn the rear nut up against the equalizer to take up *some* of the slack in the cable. Tighten the front nut, as shown above, to lock the adjustment.



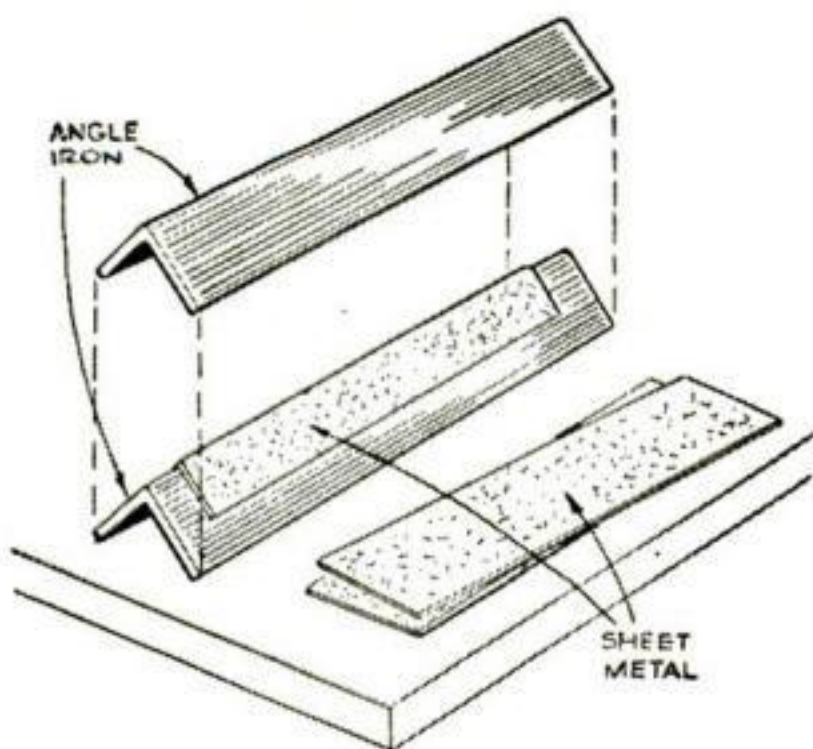
MASTER CYLINDER should be checked every 5,000 miles. Brush away any dirt around the filler cap and unscrew it with a wrench. Add only enough heavy-duty brake fluid to bring the level to within a half-inch of the filler neck. If the master cylinder requires filling more often, look for signs of a leak at the connections and at each of the wheel cylinders. **END**

PS Shop Notebook



Chuck Is Caliper

Forgot your drill gauge? You can quickly find the right-size drill for drilling a bolt's clearance hole—by using the drill chuck as a caliper. Close the chuck's jaws loosely on the bolt, then take the bolt out without disturbing the chuck's setting. Now try the shanks of several drills until you find the one that slips into the chuck jaws with the least amount of play.—*John Tavean, Mentone, Calif.*

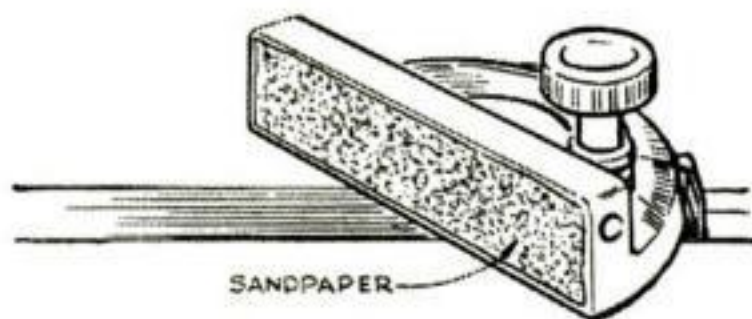
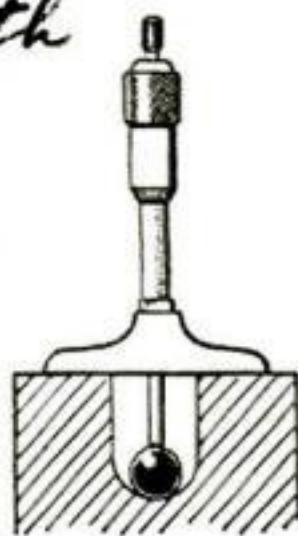


Bending Sheet Metal

Crisp corners can be bent in light-gauge sheet metal by pressing the metal between two pieces of angle iron. The angles work like a male-and-female stamping die, shaping the metal quickly and evenly. Use a vise to squeeze the angles over the metal, or tap the top angle with a hammer to press the metal smooth.—*Victor J. Lamoy, Upper Jay, N.Y.*

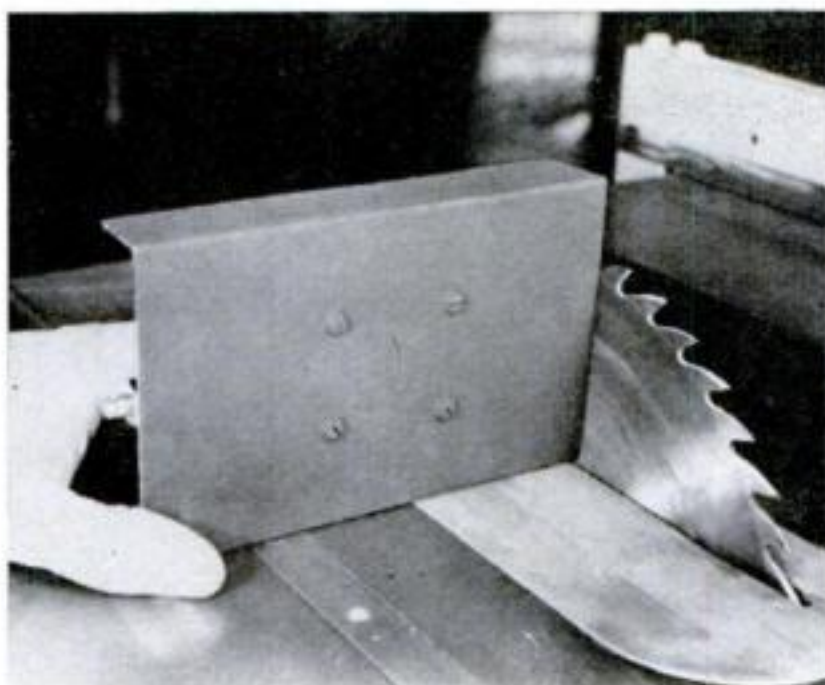
Measuring Depth

To find the depth of a round-bottom hole, drop a small bearing ball into it and measure down to the ball. Add the diameter of the ball to the reading.—*Frank LaSaracina, NYC.*

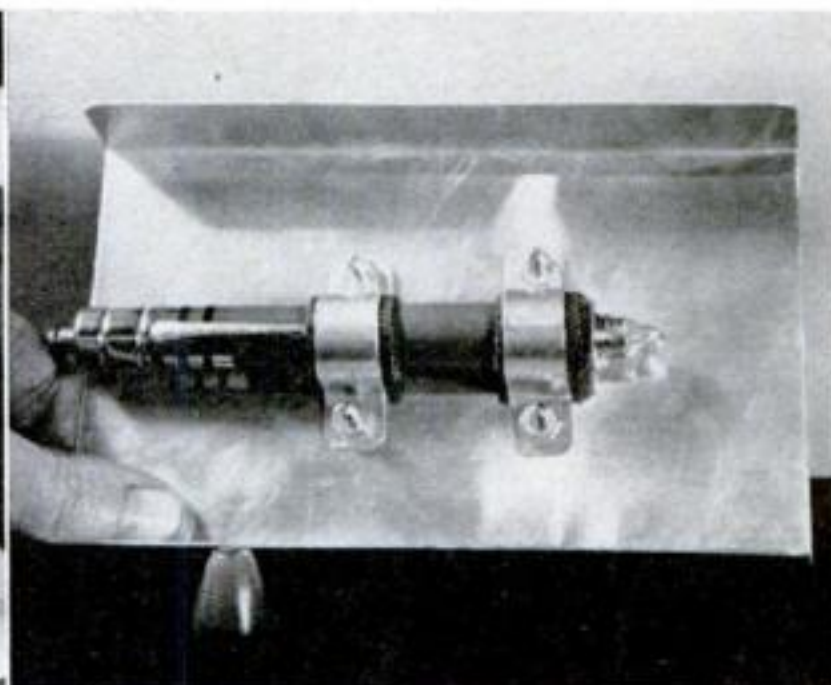


Non-Skid Miter Gauge

If the work creeps when you are cutting miters, try slip-proofing the miter gauge with medium-grit sandpaper. Contact cement will bind it to the gauge's face.—*B. F. Tinney, Charlottetown, P.E.I., Canada.*

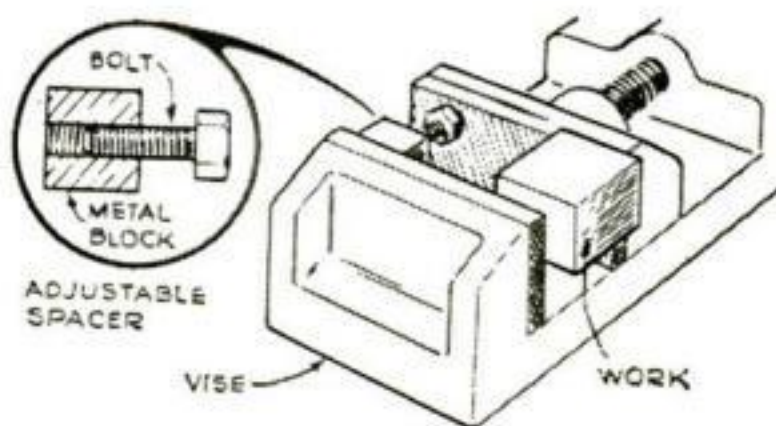


An illuminated gauge, made from sheet metal bent and filed square, makes checking easy where back lighting is poor. Paint one surface of the gauge black and mount a pen-



size flashlight behind it to light the meeting edges. When the surface being squared is true, the gauge's edge fits flush and light doesn't show. —C. C. Cooley, New Buffalo, Mich.

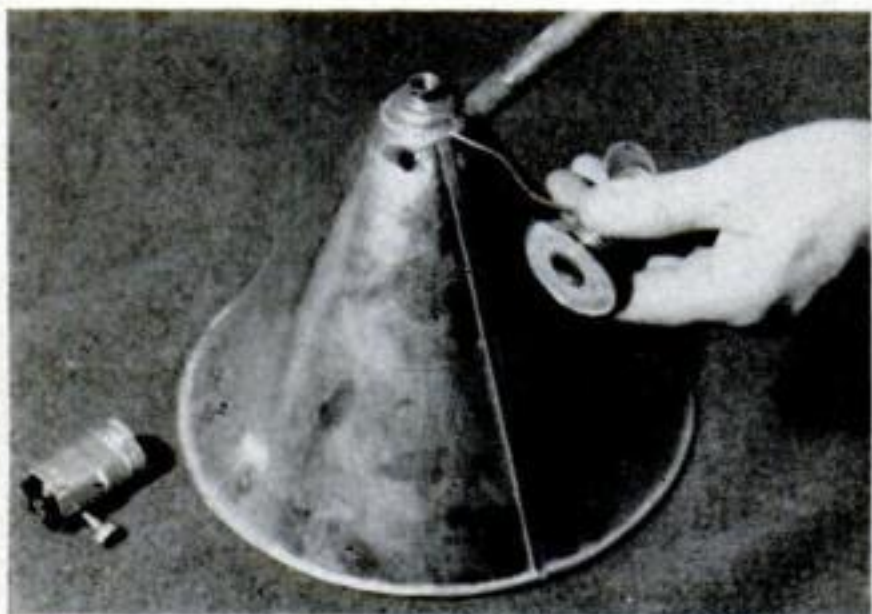
Keep vise jaws from twisting out of parallel by clamping this adjustable spacer between the jaws on the side opposite a short piece being gripped. Besides being easier on the vise, the spacer distributes the pressure and helps the jaws hold the work tighter. —Hugh Lineback, Stillwater, Okla.



HAVE YOU TRIED THIS?

Pleasing designs can be punched in soft metal and wood with a piece of band-saw blade. Bend it to the desired curve and hold it on the work while you tap its back with a mallet. For straight-line designs, it's best to hold blade against a straightedge.





LAMP-SOCKET CAP is soldered into funnel after spout has been cut off, as at left. Drill a hole through side of funnel for the switch knob, and if necessary dimple the metal around the hole so the knob can be gripped easily. At center, a fitting called a "blind nozzle" is hammered into the top of the upright conduit to join boom to stand. Nozzle has nominal $\frac{1}{8}$ "

threads on inside, nominal $\frac{3}{8}$ " threads on outside, and makes a jam fit inside the conduit that will not pull out. When the fitting is in, hacksaw off the upper half flush with the end of the conduit. This exposes the $\frac{1}{8}$ " threads inside, as shown at right. The lamp swivel, with matching threads, is then screwed into the top of the nozzle. Boom then bolts to the swivel.

How I Made a Modern Boom Lamp

By Ron Anderson

I DO my reading under a modern boom lamp. It tilts up and down and swings in any direction to put the light right where I want it.

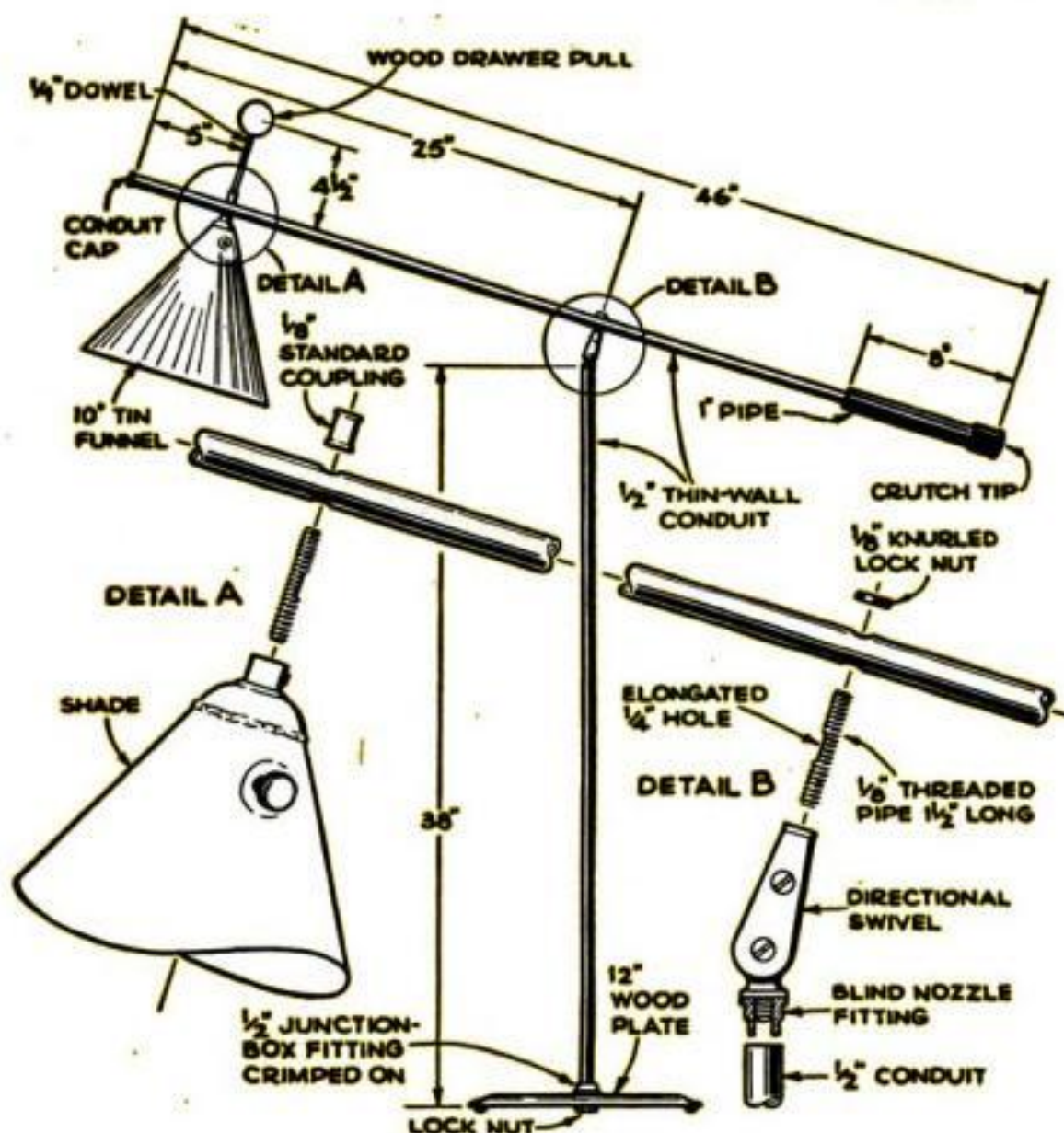
The parts are common items from hardware and lighting-supply stores, chosen to fit together with a minimum of work. The boom and stand, two lengths of $\frac{1}{2}$ " thin-wall electrical conduit, are joined by a handsome, brass lamp swivel. When you buy the conduit, sold in 10' lengths, have a $\frac{1}{2}$ " junction-box fitting crimped on one end. This threaded end makes it easy to attach the stand to the base.

The shade is made from a funnel about 10" in diameter, with the spout cut off and a standard rotary-switch lamp socket

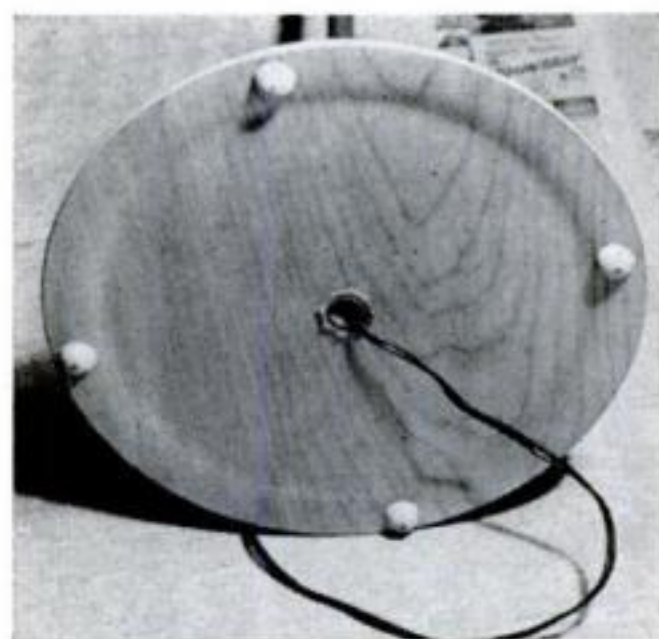
soldered into the hole. Two $\frac{1}{8}$ " (nominal size) threaded pipe nipples hold the shade to the boom and the boom to the stand. Drill and file an elongated hole in the side of each one so that the lamp cord can be fed from the socket down inside the boom and through the stand to the bottom. Ream the holes smooth so they won't fray the lamp cord.

To balance the shade, slip a piece of 1" pipe about 8" long on the back end of the boom and shim it with tape for a snug fit. Slide it until the lamp balances in any position, then drill a small hole through the pipe and into the conduit. Pin the pipe in place with a screw turned into a dowel slipped into the conduit.

For a final touch, top off the shade mount with a handle—one of those hardwood balls sold as drawer pulls. **END**



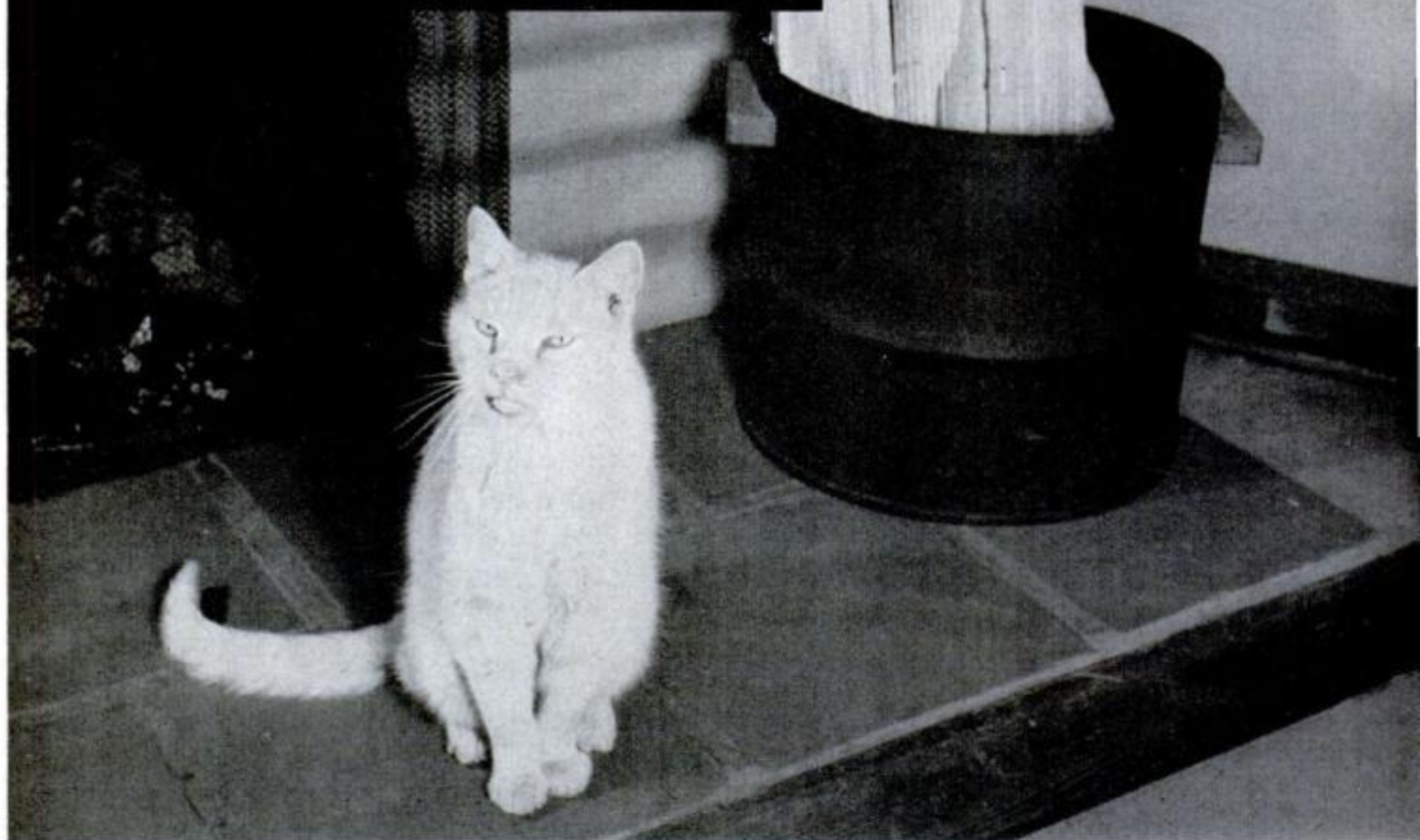
SIMPLE ITEMS are all it takes to make the handsome boom lamp shown in the drawing at left. The height and boom length are for an average chair, but can be varied to suit any furniture.



UNPAINTED WOOD PLATE about 12" in diameter makes a good-looking base. End of conduit, bought with threaded connector crimped on, is inserted in $\frac{3}{4}$ " hole in plate and tightened with a locknut. Drive in four rubber-headed tacks to serve as feet.

Short Cuts and Tips

FROM PS READERS



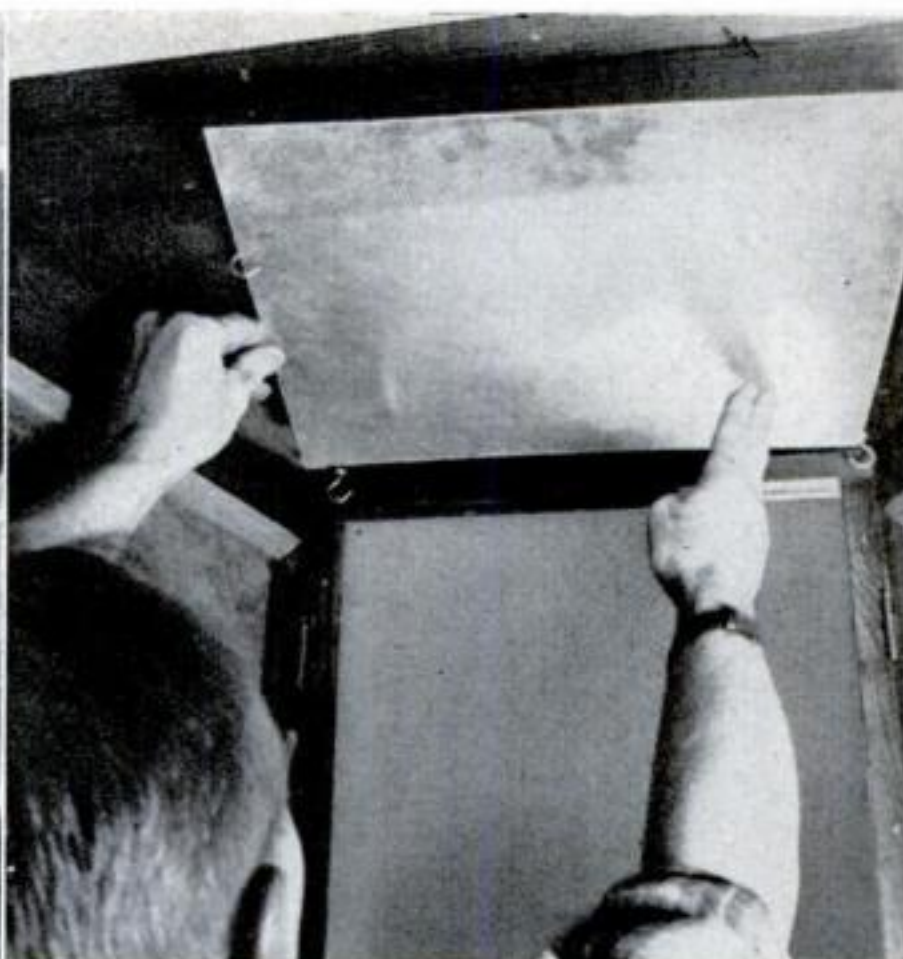
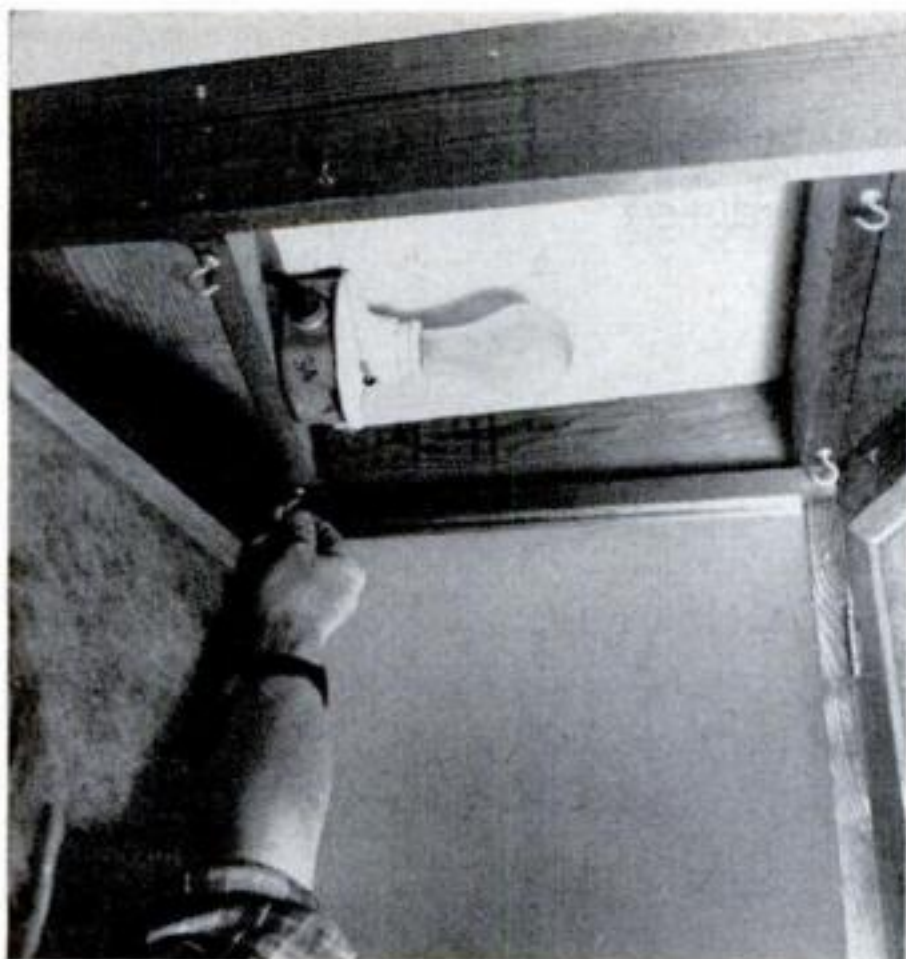
Budget-Saving Hearth Bucket Is Made from an Oil Drum



You can fashion a good-looking wood-box for the hearth from a 25-gallon oil drum. Cut off the top third of the drum and paint the resulting bucket with flat-black enamel. For cutting, I used an abrasive wheel on my power saw. This calls for caution and safety goggles.

Blocks of wood, 1 $\frac{1}{4}$ " by 2" by 6", shaped to the curve of the drum and fastened with screws from the inside, make handles.—*Paul Corey, Sonoma, Calif.*

▶▶▶ WHEN I couldn't locate an oil leak under my car, I cleaned off the oil pan with gasoline and applied white paint. Next day stains showed up leaks around two bolts in the cover. I tightened these and haven't had a leak since that time.—*C. E. Cassaday, Kansas City, Mo.*



Diffusers Over Recessed Lamps Give Soft Light

I HIT on this easy way to get diffused light in my recreation room. I boxed in the light fixtures and covered each with a square of glass-fiber. By sliding the translucent panel behind cup hooks in

the wooden frame, I left a gap to let heat escape. Wall lights can be recessed the same way. Choose maize, rose or opal glass-fiber for the most effective light.—*Carl Paulson, Los Angeles.*

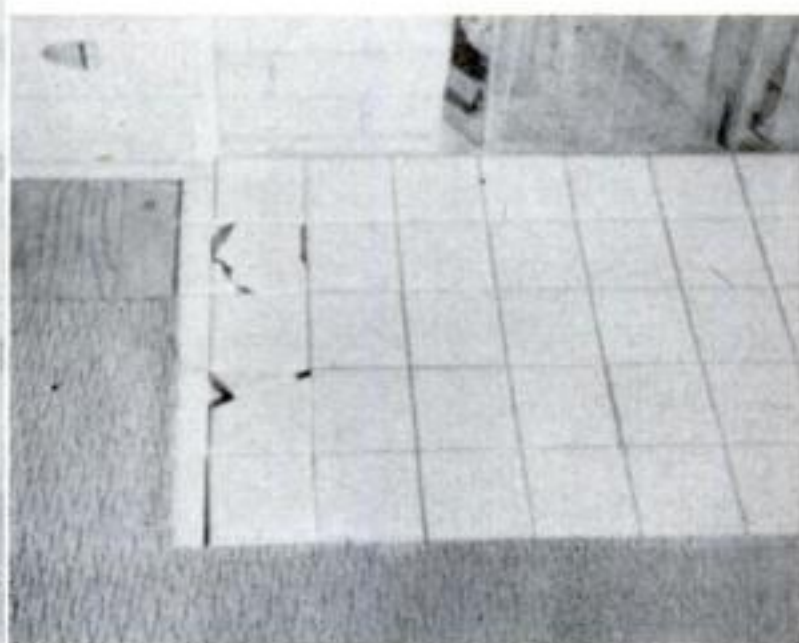
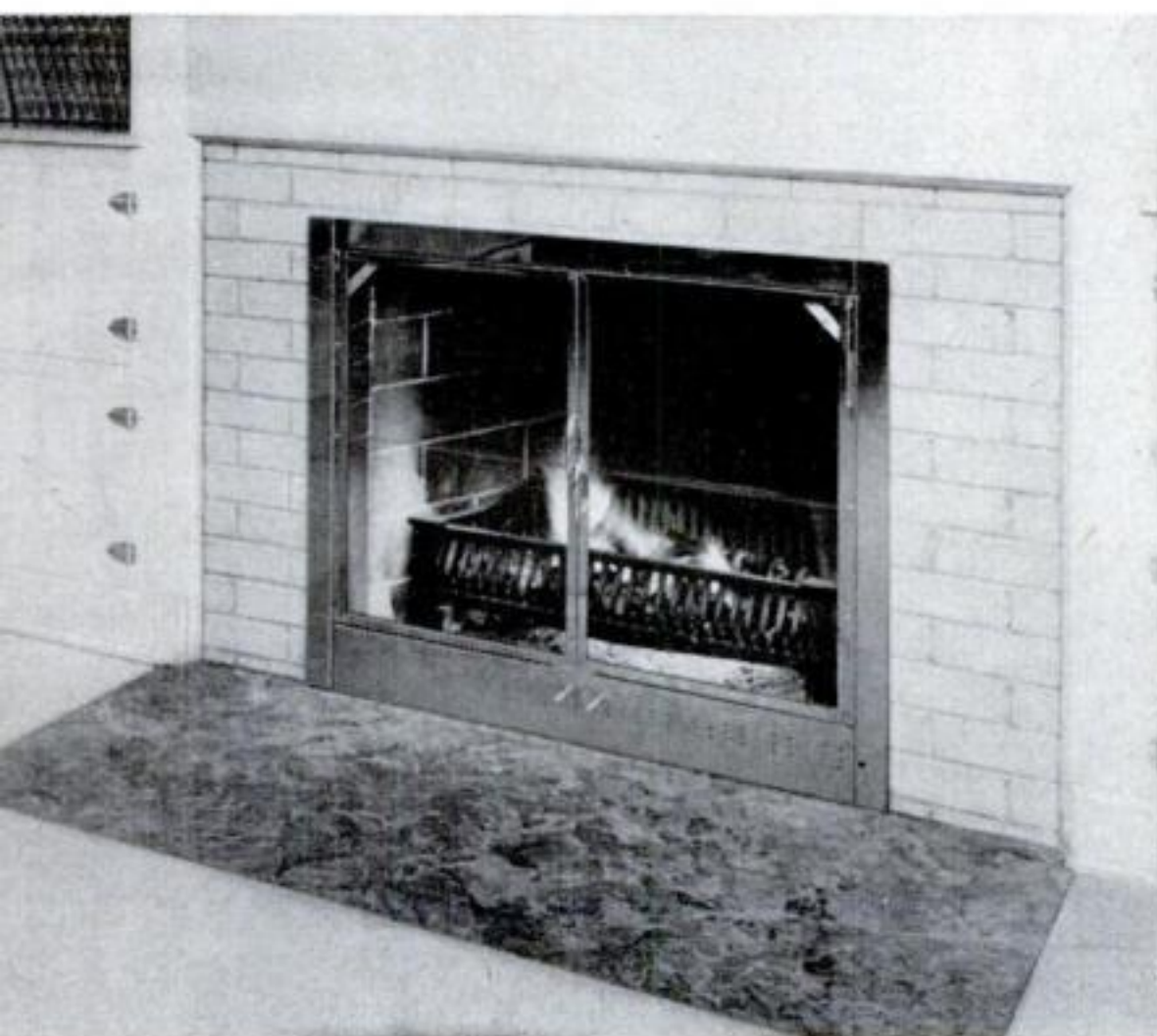
Wall Paneling Does Face-Lifting Job on Hearth

IF THE tiles of a hearth are broken, you can resurface with a hardboard panel of imitation marble such as Marlite. The old hearth can stay—just fasten any loose tiles or broken pieces with cement.

Cut the panel to size with a fine-tooth

saw and sandpaper the top corners lightly to prevent their chipping. Spread mastic thinly and evenly over the tiles and back of the panel, then bond them together. In about 24 hours the adhesive should be dry enough to stand the heat of a fire.

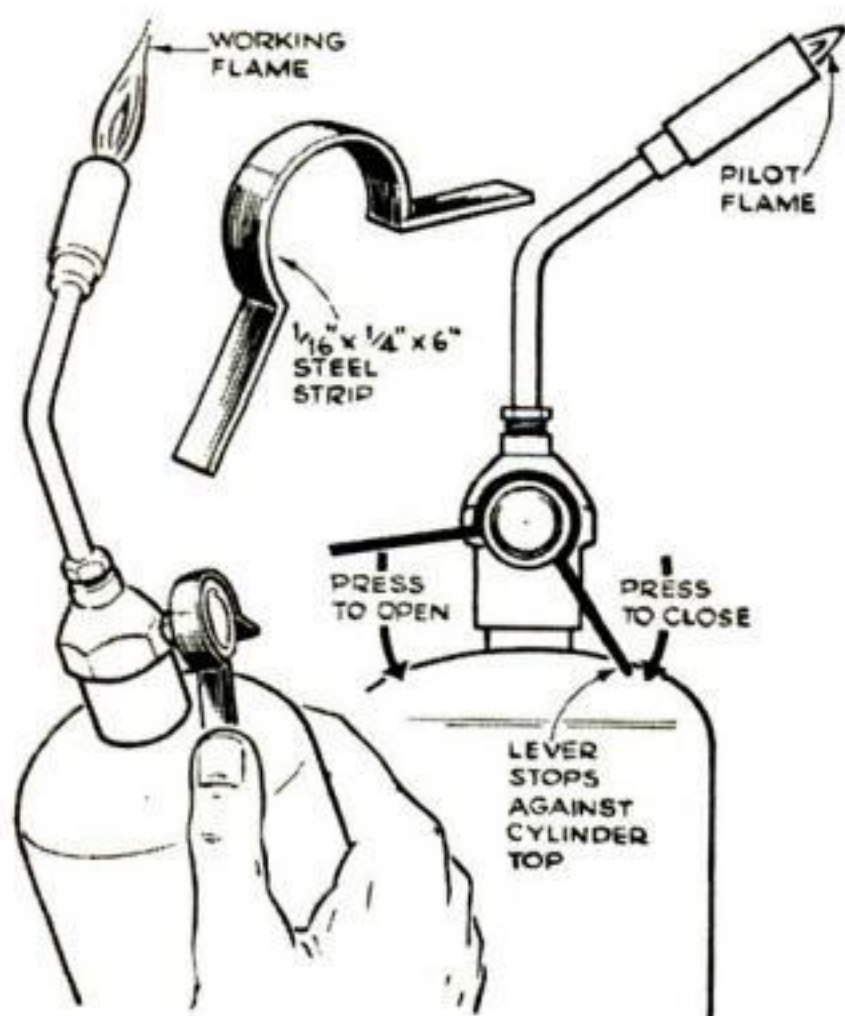
Since the marbleized paneling is designed for decorating walls, it will have to be protected against scuffs and scratches when used underfoot. To do this, remove its gloss cautiously with fine steel wool, and then apply a coating of good plastic floor finish.



Short Cuts and Tips

Hedge Shears Cut Insulation Batts

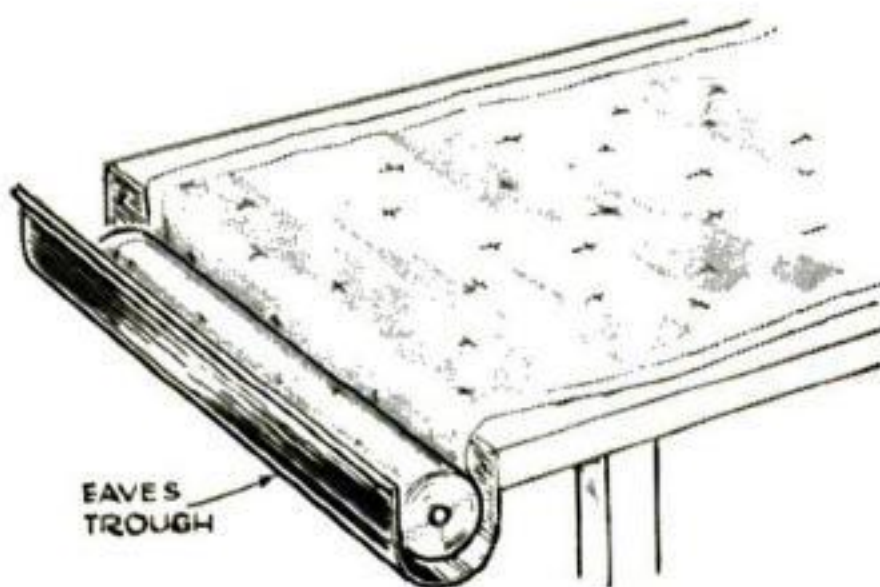
I HAVE found that well-sharpened hedge shears will cut blankets of mineral wool quickly and neatly. They slice through the thick insulation without the raggedness and shredding that so often result when a knife or a saw is used for this.—*Herbert Y. Moon, Orient, N. Y.*



Trigger on Torch Saves Fuel

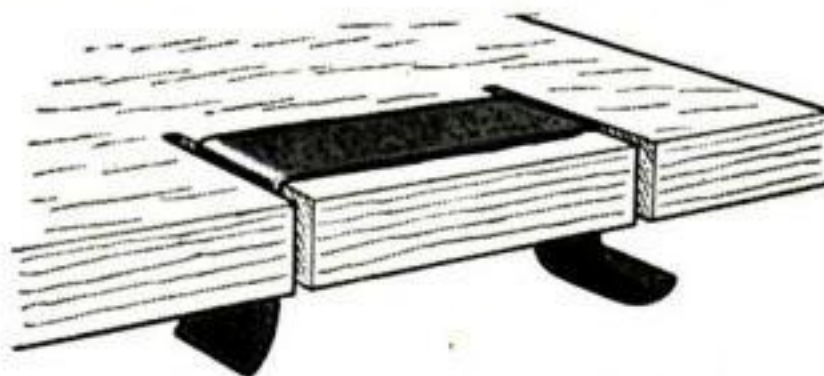
A TRIGGER control on my propane torch lets me lower the flame to "pilot" size with the flick of a finger when I set the torch aside. It is just a strip of 1/16"-thick steel bent to a friction-tight fit around the valve knob.

To attach it, I lit the torch and adjusted it to burn with a low flame. Then the "legs" were pulled apart until the piece snapped into place, providing two levers that turn the knob in either direction. A mark on the knob makes it easy to install the control in the same position each time it is used.—*Andrew Vena, Philadelphia.*



Trough Holds Wallpaper Roll

A LENGTH of eaves trough at the end of the papering table will keep a roll of wallpaper from rolling up or sliding to the floor when you are measuring off a strip. Fasten the trough to the table with screws.—*Victor H. Lamoy, Upper Jay, N. Y.*



Board Grips Pencil Pointer

TWO 1"-deep saw kerfs cut 2 1/2" apart in the edge of my drawing board grip a ribbon of abrasive paper for pointing a drafting pencil. The 3/4"-wide sharpening strip slipped into the slots can be pulled along to provide a new surface as it wears.—*Norm Jacky, Fond du Lac, Wis.*

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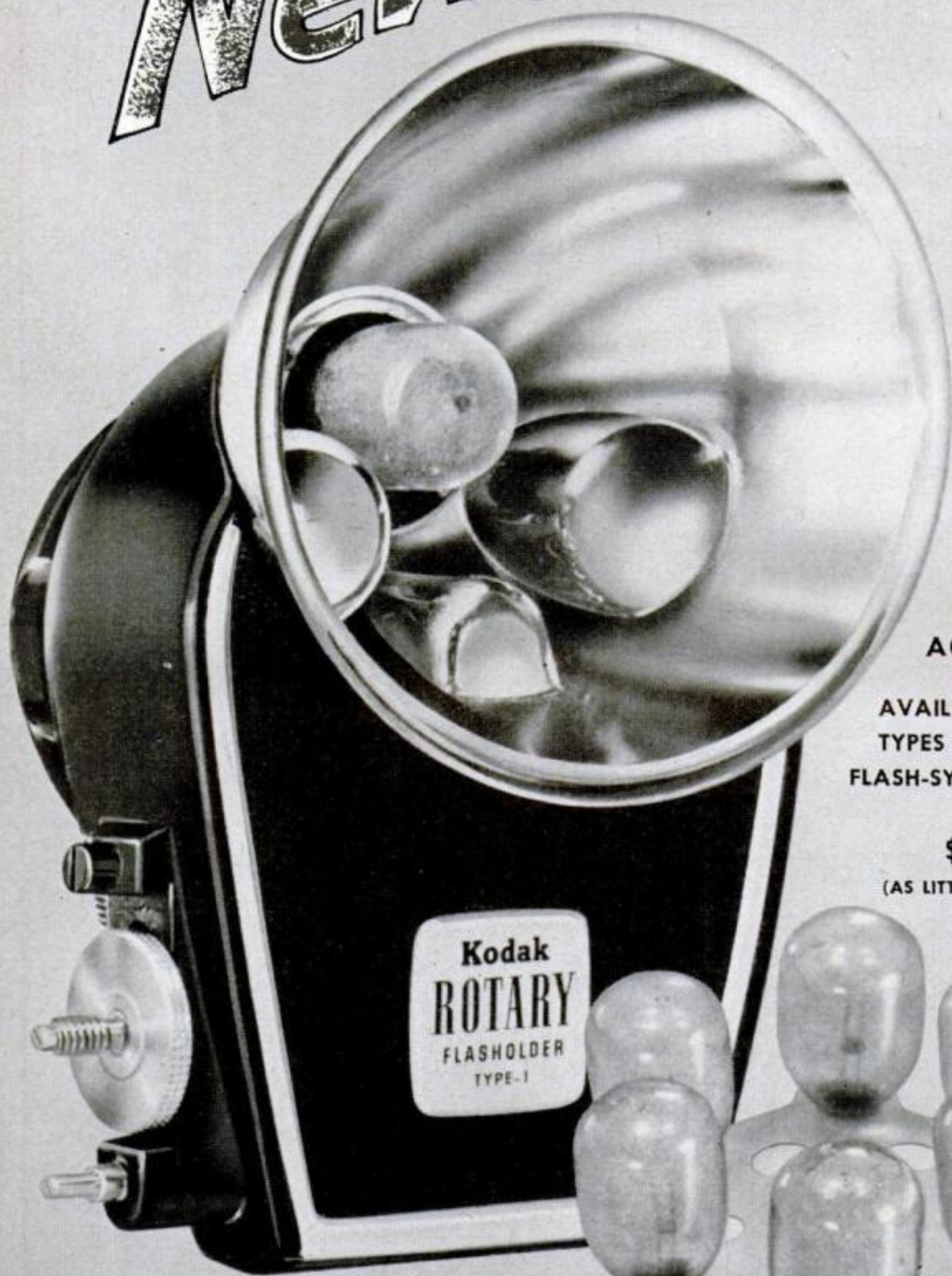
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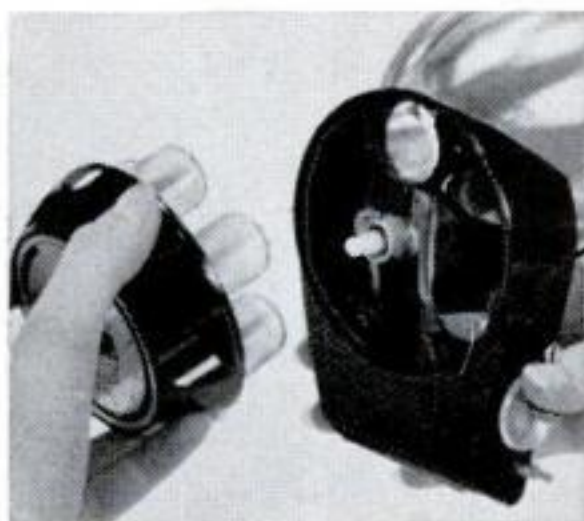
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Kodak Rotary Flashholder. You'll like the simplified exposure calculator which tells at a glance which lens opening to use. And with its B-C (battery condenser) power, you'll get top flash dependability. Available in two models to fit most synchronized-shutter cameras. Complete with a Midget B-C Flashpack, flashbulb carrier discs. (Batteries extra.) List prices only \$9.95 and \$11.95 . . . or as little as \$1 down.

HERE'S HOW THE KODAK ROTARY FLASHHOLDER WORKS...



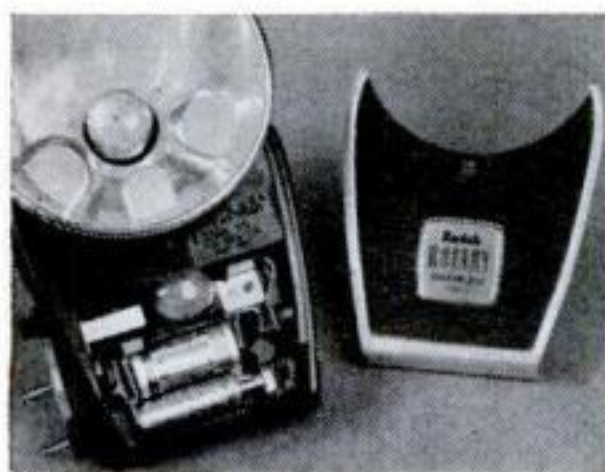
FAST, EASY LOADING. Six M2 flashbulbs are slipped into each of the two carrier discs that come with the Kodak Rotary Flashholder.



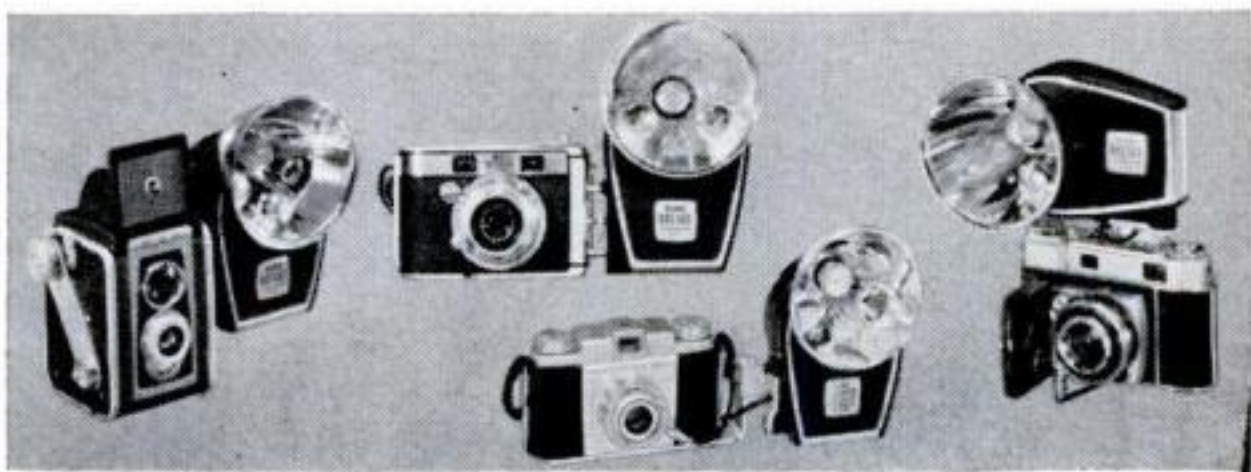
LOADED DISC OF BULBS is placed in magazine on the back of the flashholder. Bulbs are changed by simply rotating the magazine turret.



DIAL WINDOW on flash exposure calculator frames name of film in use — provides direct reading of correct exposures to be used.



BATTERY COMPARTMENT easily accessible. Rotary Flashholder operates on either B-C or penlight battery power. Midget B-C Flashpack provided.



TYPE I KODAK ROTARY FLASHHOLDERS attach directly to the bodies of cameras provided with the Kodalite-type of built-in contacts. Type II Kodak Rotary Flashholders fit cameras with an accessory shoe, or those that require a bracket mount. Bracket, cord, and connectors supplied.

(Prices are list and are subject to change without notice)

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

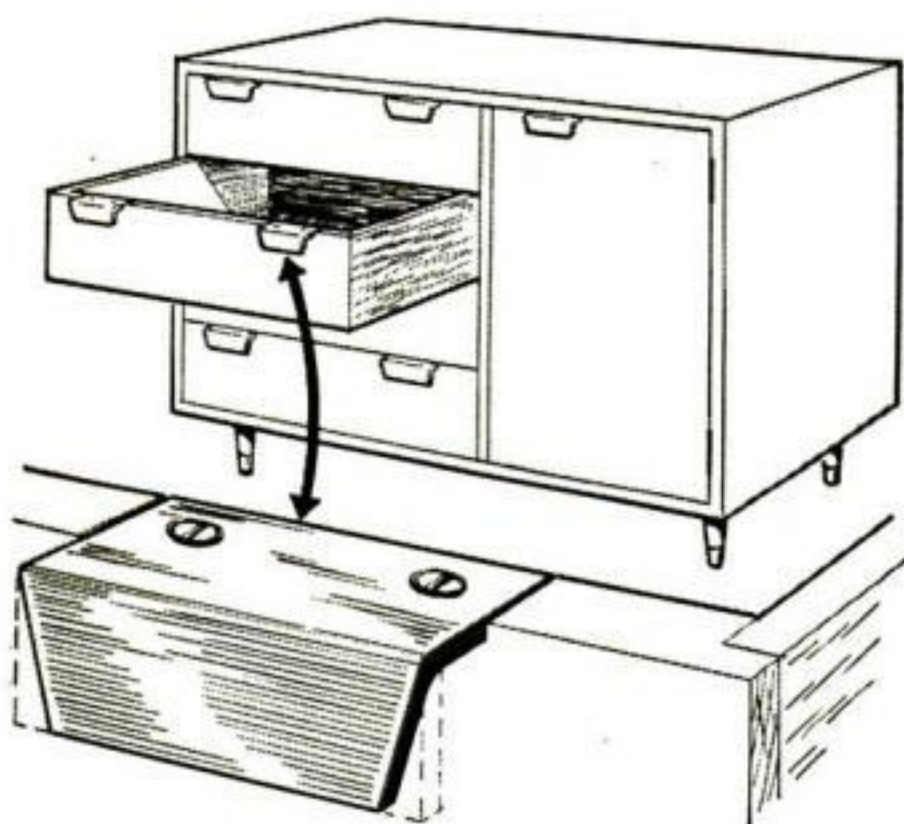
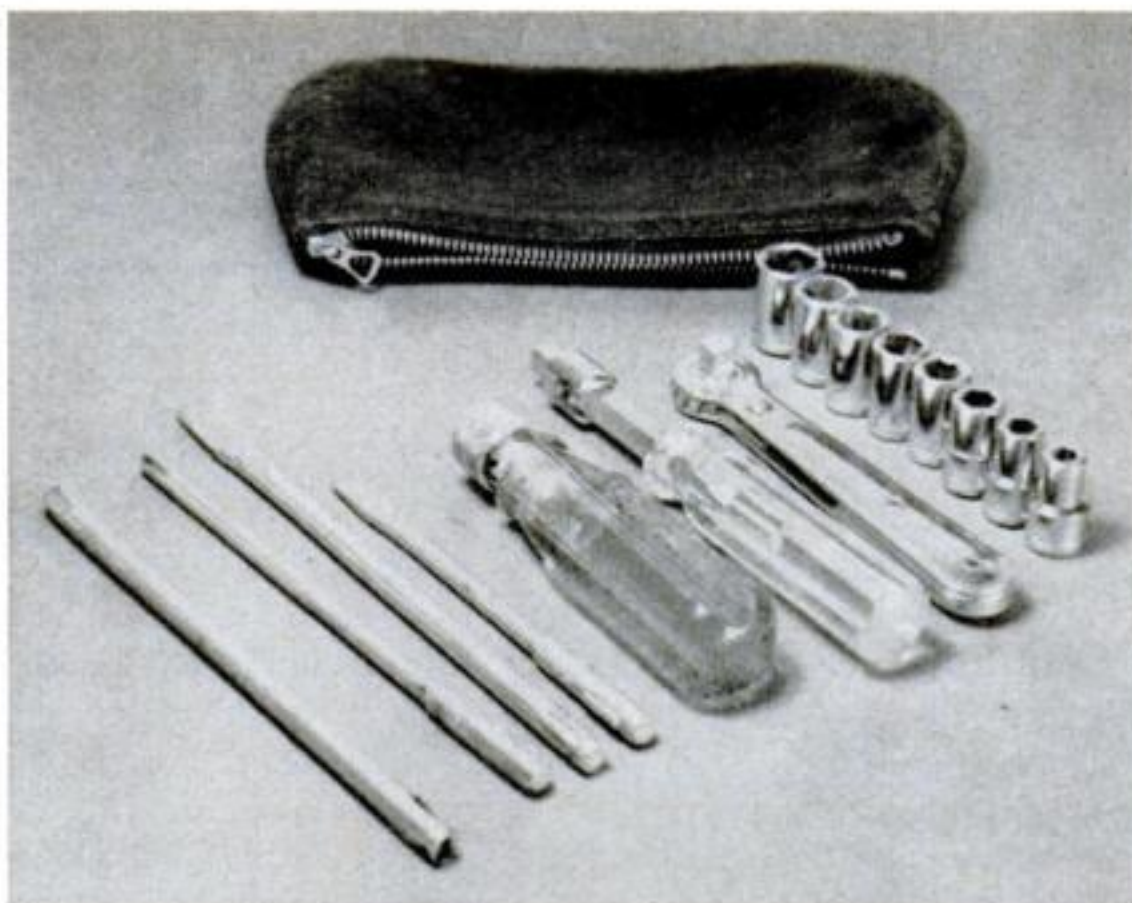
Kodak
TRADE MARK

JUNE 1957 195

Short Cuts and Tips

Tobacco-Pouch Safe Stores Small Tools

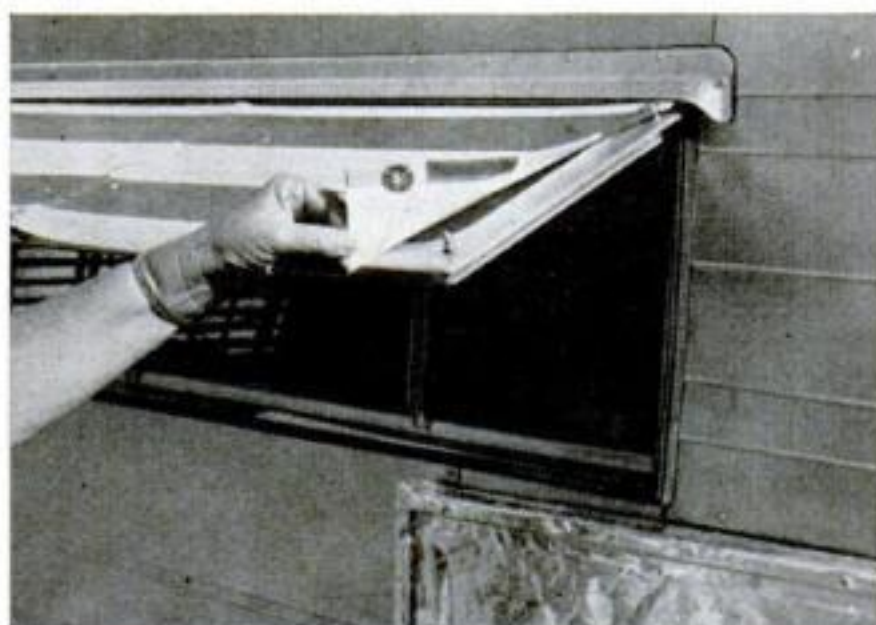
THERE'S no need to worry about losing small tools if you keep them in a leather or plastic tobacco pouch. It will seal out moisture to prevent rust and also keep them from being damaged when tossed in a tool box.—*J. A. Comstock, Wellsboro, Pa.*



Handles Cut from Angle Stock

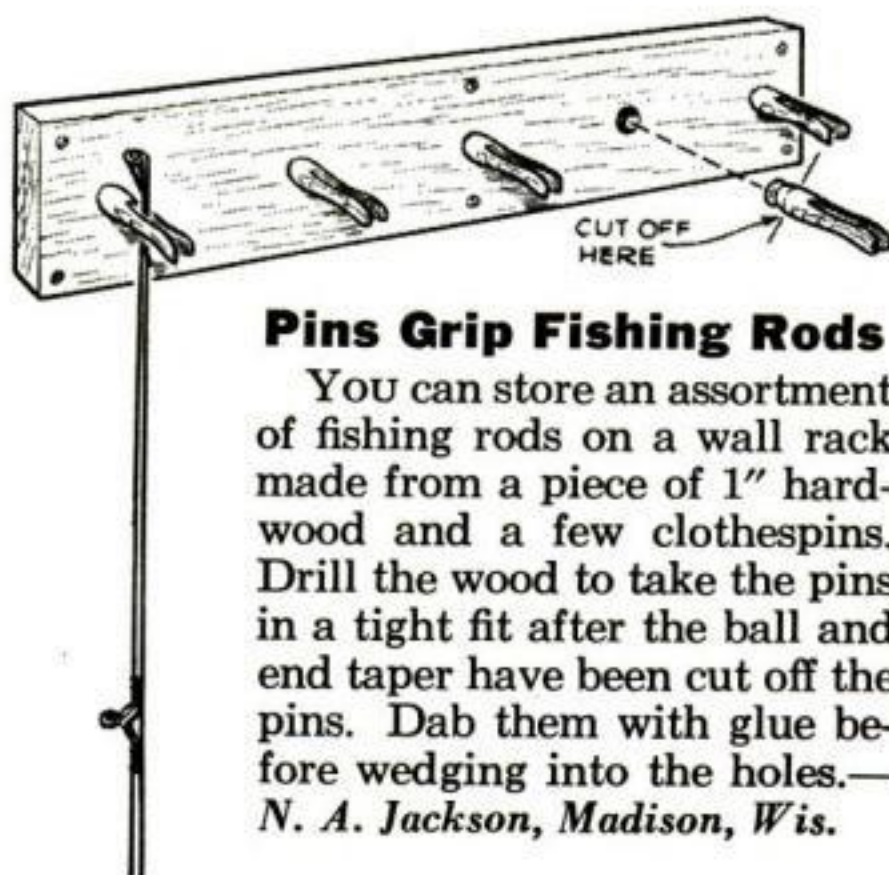
YOU can fashion short lengths of aluminum or brass angle stock into handsome drawer pulls. Round or taper the corners on one face and mortise the top of the drawer to receive the other. On a cabinet door, the pull can be fitted to top or side. Polish or brush the metal to a fine finish. Install the pull with countersunk flathead screws.—*Jack Norman, Milwaukee.*

▶▶▶ WHEN you are using a metal-turning lathe for grinding or wood-turning, it is a good idea to cover the lead screw to keep it from clogging with grit or shavings. A piece of garden hose, slit lengthwise and pressed over the screw, makes a good protector. After the job is finished, leave the rubber guard in place while you are cleaning off the other sections of the lathe.—*R. E. Platt, Feasterville, Pa.*



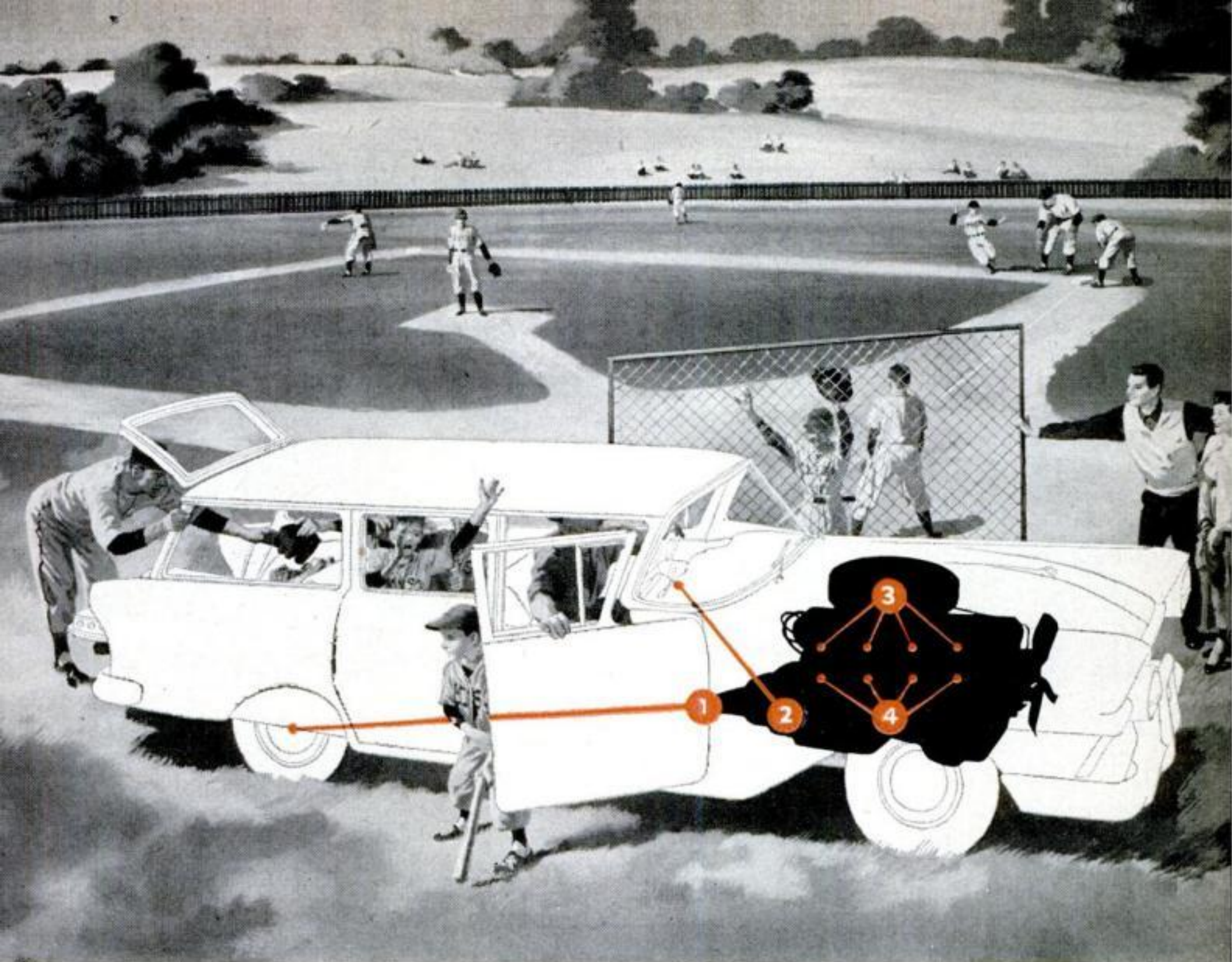
Trailer Awning Doubles as Blind

CANVAS cut to fit trailer windows will act as awnings by day and as shades when the windows are shut at night. Fix the canvas to the window frame with snap-on fasteners of the machine-screw type.



Pins Grip Fishing Rods

YOU can store an assortment of fishing rods on a wall rack made from a piece of 1" hardwood and a few clothespins. Drill the wood to take the pins in a tight fit after the ball and end taper have been cut off the pins. Dab them with glue before wedging into the holes.—*N. A. Jackson, Madison, Wis.*



1 More road horsepower— Your car will act young again when you put in 5-rib Champion spark plugs! Independent engi-

neers proved new Champions give cars of all makes an *immediate* boost in the real power actually delivered at the rear wheels. Most

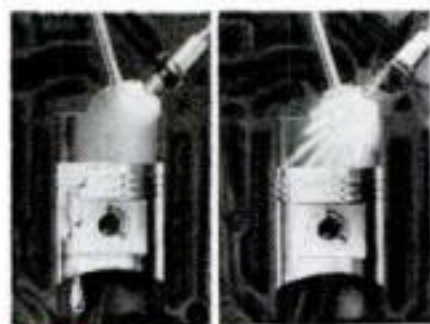
cars gained 6% to 31%—for better hill climb and safer passing. No wonder 9 out of 10 racing drivers insist on Champion spark plugs.

If you haven't changed your plugs in about 10,000 miles—

You can make your car 4 ways newer with Champion spark plugs



2 Quicker starts—Your engine will start quicker, too...save time and battery wear. Tests with cars whose plugs had gone about 10,000 miles show that new Champions cut starting time as much as 71% — with an average of 39%!



3 Less engine wear— You'll save costly repairs! Old misfiring plugs (left) dilute oil with raw gas. New full-firing Champions (right) burn the gas...protect oil from dilution. *When changing oil—be sure to check your spark plugs!*



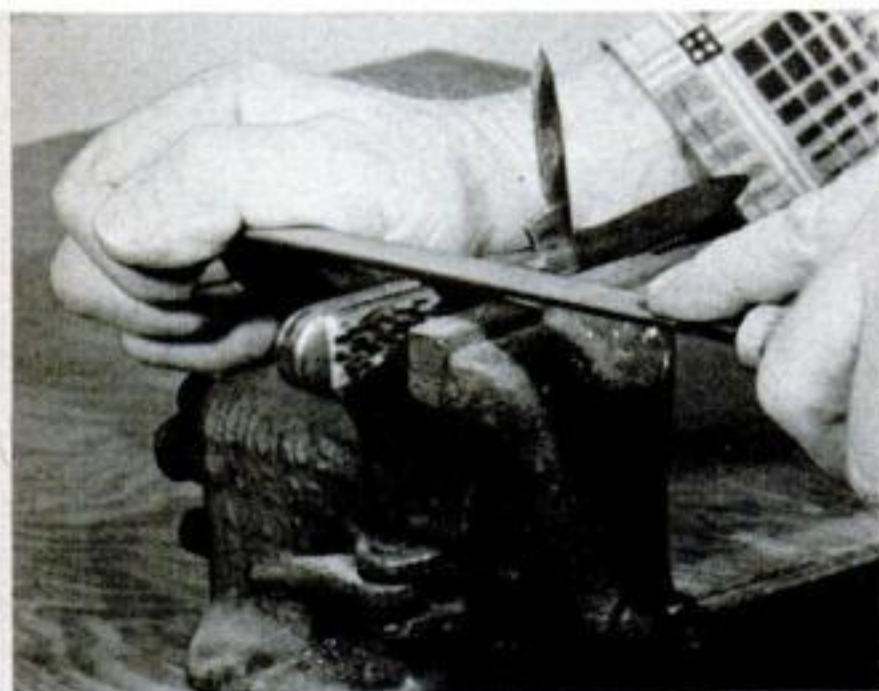
4 Lower cost-per-mile — You get top power and gas economy for life of the plug. Champion's great new Powerfire electrode stands up better than ordinary types—as photo above shows. Always insist on 5-rib Champion spark plugs!



CHAMPION

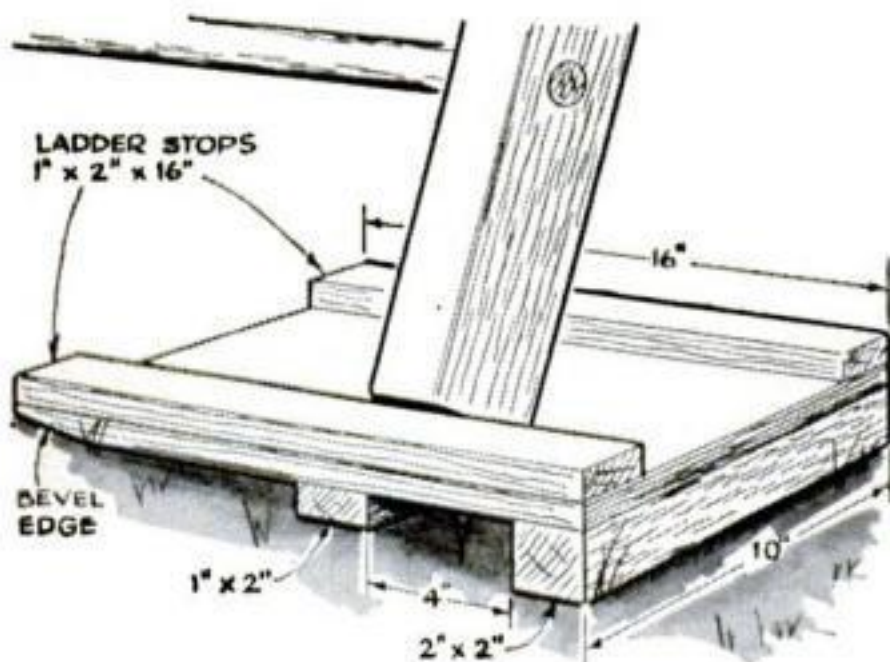
LOOK FOR THE 5 RIBS

Short Cuts and Tips



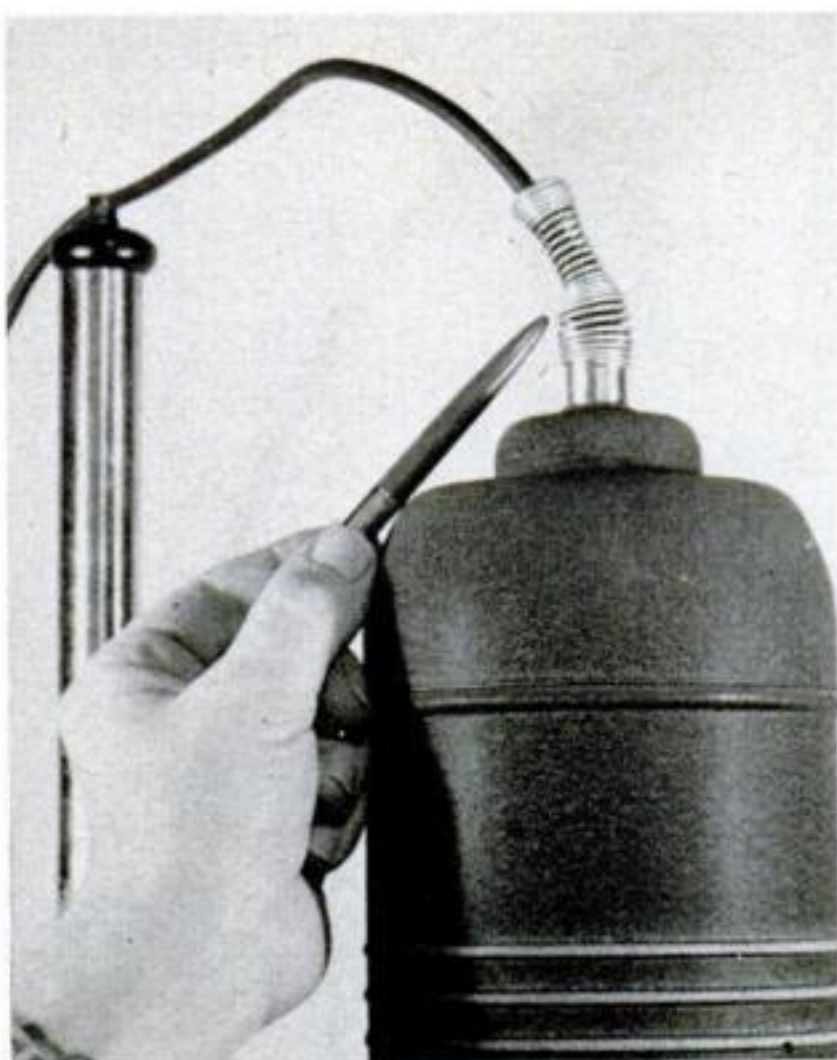
Slots Help to Open Knife

IF THE blades of an old jackknife are hard to open because they pivot in too far, file the handle to make it easier to reach the notches on the blades. Put the open knife in a vise and, with a half-round file, cut a depression where the notches fall when the knife is closed.—*W. H. McClay, Pasadena, Calif.*



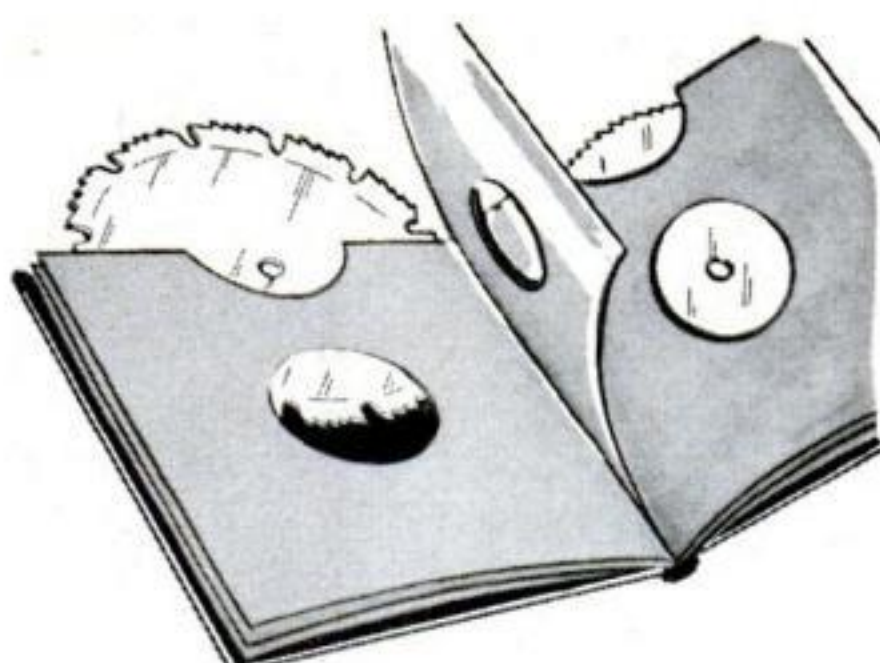
Stepped Wedge Levels Ladder

WHEN you're using a ladder on uneven ground, a wedge like this makes a good leveler. Use close-grained hardwood for the platform and nail lengths of 1" and 2" stock across the grain near one edge. Then bevel the opposite edge so that you have three graduated points of support. Stop strips nailed at each side of the top keep the ladder from slipping off the leveler.—*Robert V. Thompson, Clinton, Ia.*



Wire Guards Enlarger Cord

HEAT and strain may crack the insulation on enlarger cords where they enter the lamp housing. A good way to extend the life of the cord is to attach a spring guard to the top of the adjusting tube where the cord enters it. You can salvage such a guard from the plug end of an old ironing cord.—*C. Williams, Los Angeles.*



Album Stores Saw Blades

AN OLD record album makes a safe and handy storage file for the blades of a table saw. Use every other pocket, or slip a thin cardboard sheet into each one to make a thicker padding between blades.

▶▶▶THE lens of a projector or a microscope will be kept free of dust if you twist a piece of transparent plastic wrap over it before you store the instrument.



TRIPS WITHOUT SLIPS...

WEEK ENDS . . . vacations . . . plan your family motor trips . . . *without slips.*

Item: Be sure you take your car jack, lug wrench, other tools. You could miss them a lot . . . later. Flashlight, paper towels, etc., can come in handy.

Start early: Ask "Mr. Service" . . . your nearby Texaco Dealer . . . for a special Texaco Touring Service routing for best routes . . . to avoid detours. Have him check your car . . . tires,

battery, filters, fan belt and other potential trouble spots. His Marfak chassis lubrication will give you smoother, quieter riding, easier handling.

Invitation: Stop where you see those green and white Texaco Registered Rest Room signs . . . *you're always welcome.*

And, on the road, let Texaco Dealers give you their famous "Circle Service" for clear vision and safer driving.

Here's "slip" that safeguards...

It's Marfak chassis lubricant! Lubricates perfectly yet clings to vital points. Seals itself in to protect against road dirt, dust and water. Lasts longer for "cushiony" riding, easier handling, bearing wear protection. Get Marfak. See your Texaco Dealer . . . *the best friend your car has ever had.*



TEXACO DEALERS

IN ALL 48 STATES

Texaco Products are also distributed in Canada, Latin America, and Africa

THE TEXAS COMPANY



JUNE 1957 199

Short Cuts and Tips

.....

Hinges Mount Trailer License

I HINGED the license plate on my trailer so that it pivots out of the way instead of getting bent if I raise the drawbar too high while hooking up. The hinged plate swings free, too, when the trailer rides through tall weeds or roadside gullies.

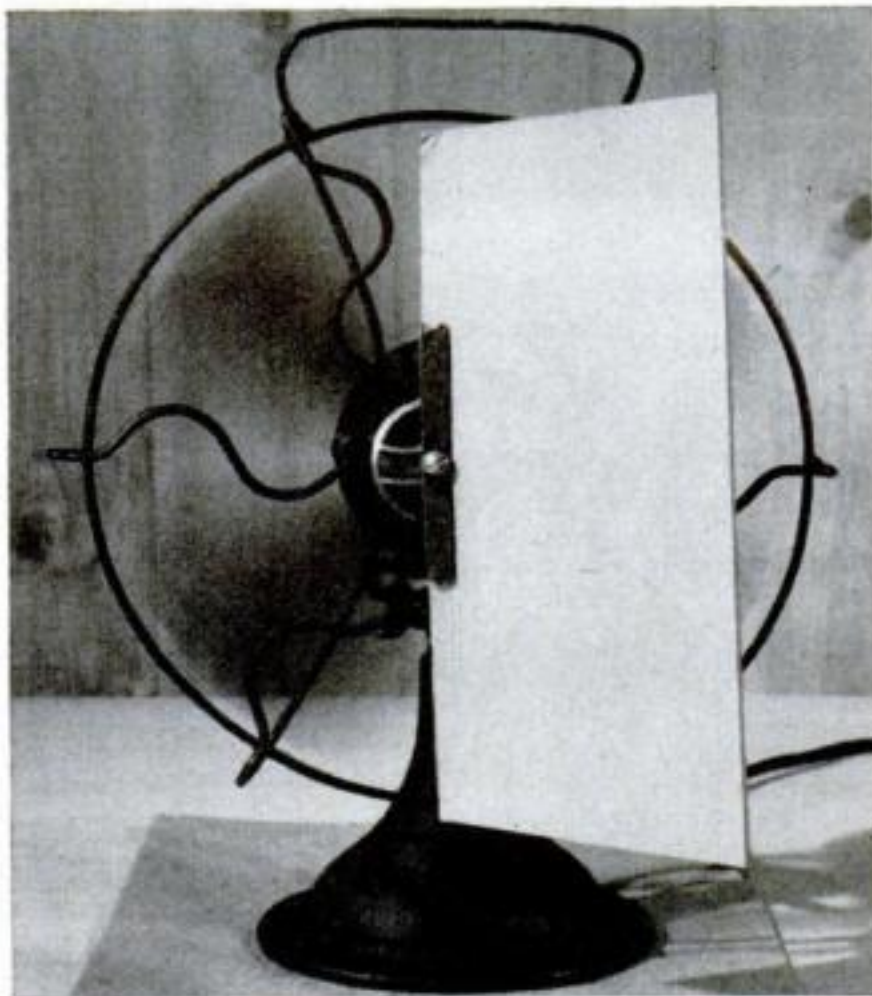
The same mount can be used to fasten a plate low on a pickup truck.

—W. J. Fesselmeyer Jr.,
Santa Rosa, Calif.



TV Lead Makes Sturdy Strap

WHEN my binocular strap wore out, I cut a new one from aerial twin-lead and punched holes near the ends for the original rivets. After a year's use, it shows no wear.—J. A. Coombs, Philadelphia.



Split Breeze Blows Two Ways

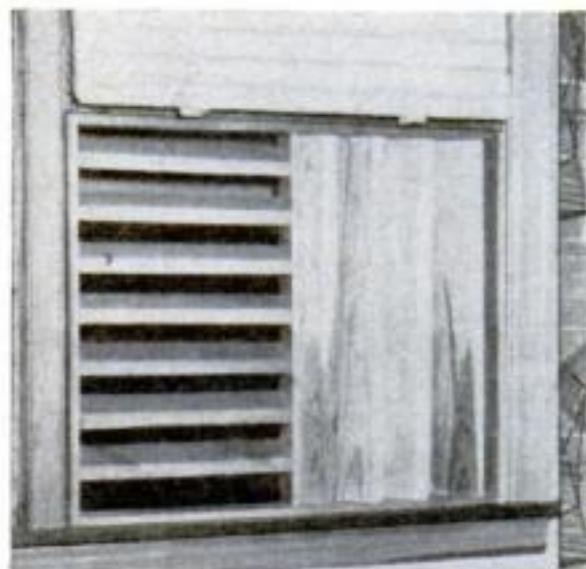
A STATIONARY fan will blow breezes in two directions if you bolt a baffle to the blade guard. Cut it from cardboard or sheet aluminum and bend one edge at an angle to deflect cool air to one side.

▶▶▶ INSTEAD of throwing away old turkish towels, cut the unworn sections into expendable wash cloths. Carry some along for various uses wherever you go on camping trips and automobile tours.—Charles K. Matthews, Woodside, N.Y.

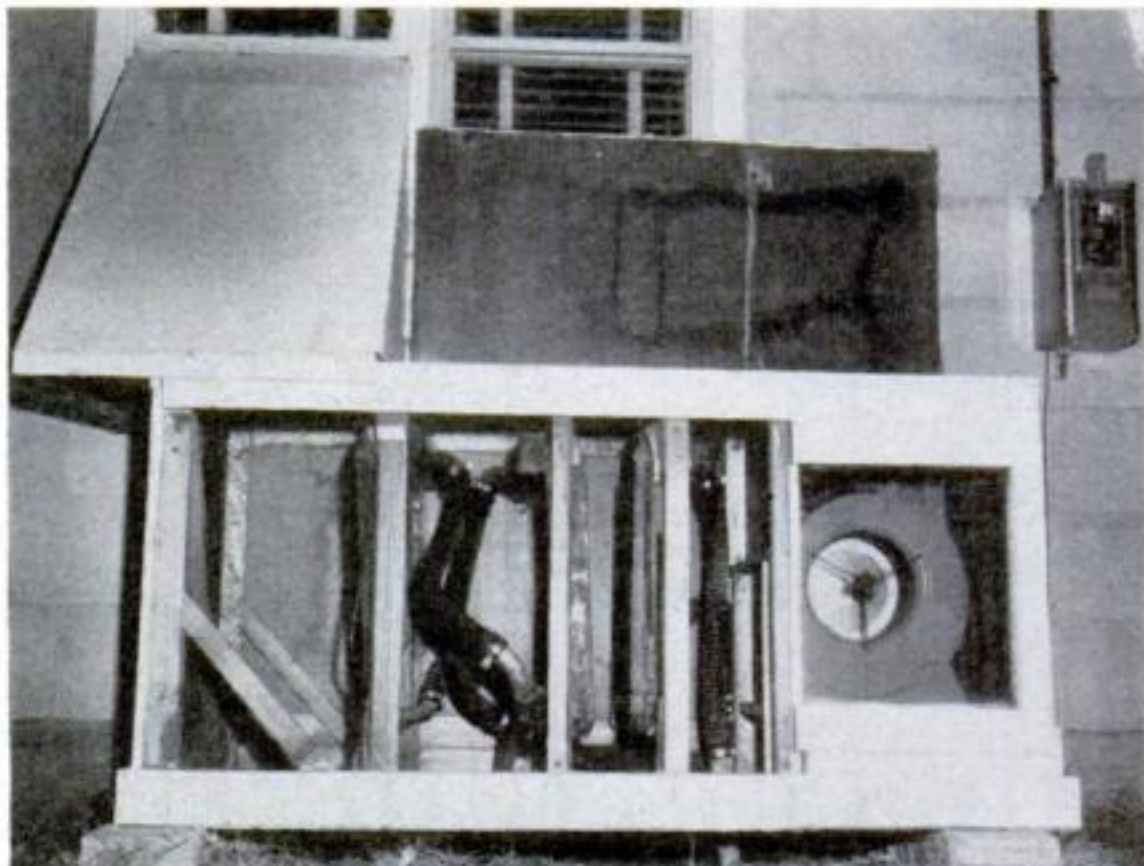
The only really new design concept for 1957 again comes from Chrysler Corporation. Full-fledged fin styling is functional—making your ride steadier at highway speeds. This New Shape of Motion* is styling leadership. Plymouth, Dodge, De Soto, Chrysler and Imperial.

**Another big reason why The Switch is On to the cars of The Forward Look*

Well Water Air-Conditions Our Home



LOUVERS IN WINDOW OPENING direct half of cool air into the living and dining rooms, the rest toward the kitchen. Outdoor unit, right, has removable panels for radiator and blower servicing. Screened openings to the blower keep out insects.

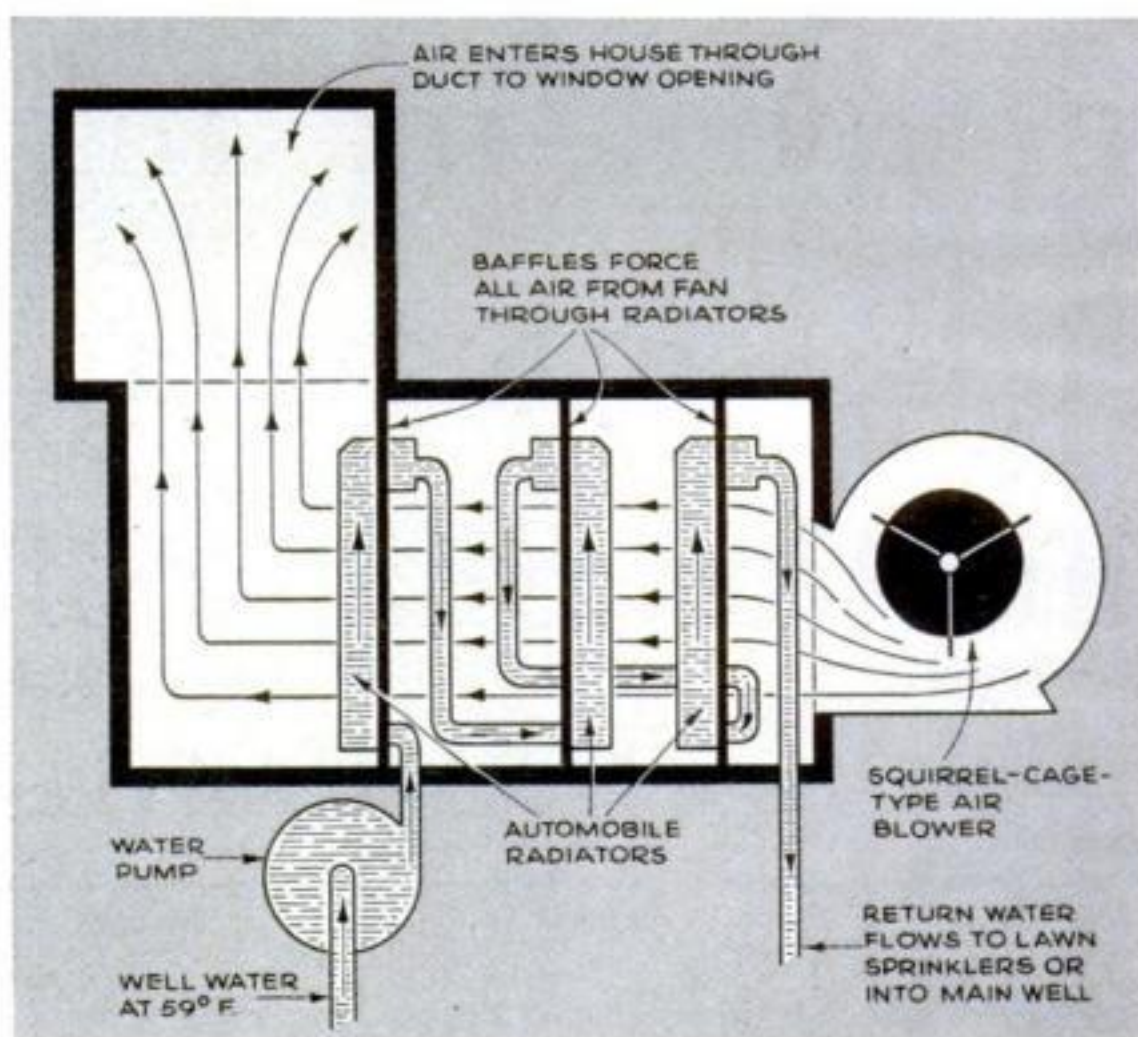


WHEN it's 100 degrees outside, the thermometer in our six-room Tulsa, Okla., home shows a comfortable 70.

The air-conditioning unit that makes this possible took me just two weekends to build. Its parts cost \$92, and I spend less than \$3 a month to keep it running an average of five hours a day.

Capitalizing on our location in the Arkansas River Valley, the coolant for my homemade air conditioner is water drawn from a 21' drive-point well. A 500-gal-on-per-hour pump lifts it, at its underground temperature of 59 degrees, and circulates it through the coils of three old car radiators set in tandem and hose-connected in series, as shown in the diagram. Having chilled the coils, the water is then either used for lawn sprinkling, or returned to its source through a second well.

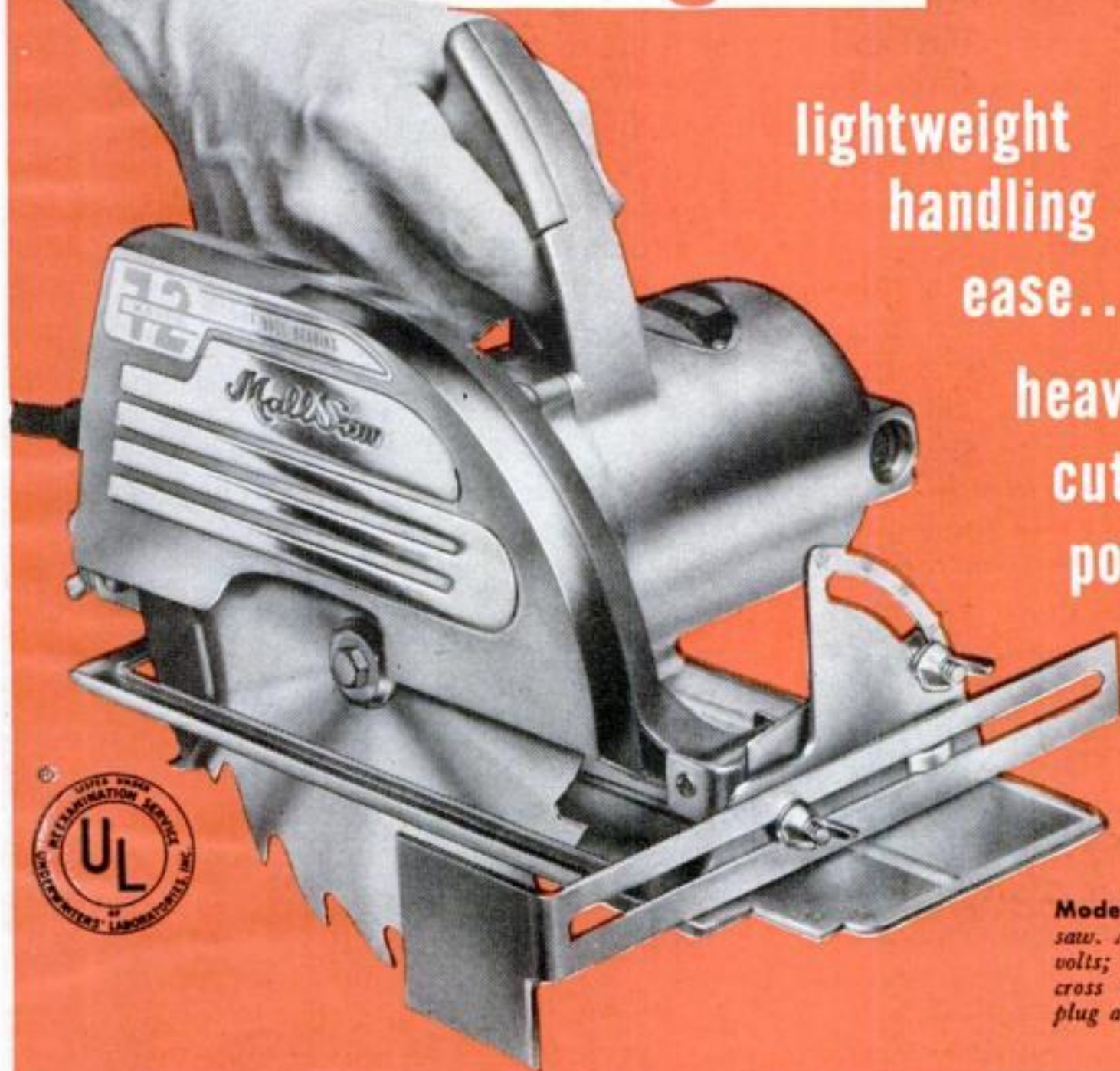
While cold water is passing through



the coils, outside air is blasted through the radiators by a squirrel-cage blower. Confined in a cabinet made from wood framing and hardboard, the coil-cooled air is then ducted through a window opening into the house. Slightly opened windows in the upstairs bedrooms attract the cool air to those quarters by convection.—*Morgan L. Powell.*

now, in power tools, too...

if it's Remington, it's right!



lightweight
handling

ease...

heavyweight
cutting
power!



Model 72. 7-inch blade standard saw. AC-DC, 25 to 60 cycles; 115 volts; 8¾ lbs. Comes with 7" rip-cross blade, wrench, 10 ft. cord, plug and ground. \$74.95*.

*these great features make our
Model 72 Saw right for you!*

- Cutting capacity of 2½ inches.
- Cuts 2 x 4 at 45° angle.
- Precision ball and needle bearings for more blade power.
- Automatic telescoping blade guard.
- Heat treated gears for longer life.



Belt and Orbital type sanders.



Electric Drills of many capacities.

*Prices and specifications subject to change without notice.

Remington

Mall

MALL TOOL COMPANY, Division of Remington Arms Company, Inc., 25000 S. Western Ave., Park Forest, Ill.

In Canada: Mall Tool Ltd., 36 Queen Elizabeth Blvd., Toronto, Ont.

Cuts tile and metal with quick blade change!

This rugged, compact saw is the favorite of many carpenters because it has the power and performance of a heavy duty model. Yet it has the handling ease of a lightweight tool—an ideal power saw for the home workshop!

Blade changing is quick and easy for plasterboard, tile, sheet metal and other tough cutting jobs. Try it yourself! When you feel its power you'll know the Remington Model 72 Saw by Mall is no ordinary saw. It is built with the quality and precision that have made Remington famous for 141 years in sporting firearms and ammunition.



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JUNE 1957 203

the French system of rating engines, the Renault has now been increased in chevaux by precisely one, from 4 CV to 5 CV—after 10 years.

By all odds, the Dauphine is the most comfortable of the four cars, to the hands and feet of the American motorist. Its four-cylinder, overhead-valve, water-cooled engine is the quietest. The car feels and acts like a Detroit product, despite the caboose engine.

The gear ratios are tailored for minimum shifting. The second gear of its three, for instance, has a range of from 10 to 45 miles an hour. This car balks less than the other three do on grades.

Nimble, it reaches 50 m.p.h. in 19 seconds on a thimbleful of power—32 horses by U. S. rating. It darts through traffic like a beagle after a cottontail. Clutch and brake are smooth. The car goes around turns on rails. For its size, it has exceptional luggage space under the "hood." Rear-seat leg room beats that in either the VW or Saab.

Body construction, however, degrades rear visibility, and the shift lever is mounted too far forward. For \$95 extra, the Dauphine comes with a magnetic clutch that throws out when the engine is idling or the gears are shifted.

Renault contends it is now in second place in U. S. sales of foreign cars, a statement that is disputed by American Motors' booming, British-made import, the Metropolitan.

Renaults are imported by Renault of France, New York, a factory branch.

The BMW Isetta

The Isetta looks like a musical-comedy version of an automobile until you step into it. And you do step into it, standing up. Then the humor vanishes. It's a complete automobile. Even a radio is available as one of only two extras. The other is a luggage rack.

Unlike those on the other three cars, the foot controls are adequately spaced. The one-lung, four-cycle engine is a modified German motorcycle job.

It took me an hour to learn to shift the Isetta's gears with my left hand. The slots for low and reverse are too close together. The torque, naturally, is low. So is the speed. The close-spaced rear wheels are on a solid axle—no differential needed. That has its disadvantage. When those wheels get astride a tar-separator strip on a highway, the rear end weaves.

The visibility all around is as big as all outdoors, and the solidity of the coachwork would give Cadillac pause.

In Europe it's a highway car. Over here, the Isetta is a go-to-market, haul-the-kids, commuter's station car. It's also an easy-to-park commercial vehicle. Lots of Isettas are being sold to around-town salesmen who operate the things for a half-cent a mile and charge the boss eight to 10 cents on the expense account.

The Isetta is imported by the Fadex Commercial Corp., of New York and Long Beach, Calif.

As specifics, the fuel-consumption figures on the little foreign cars are enticing. But the comparative efficiency of such engines is something else again. A Detroit-made car of more than twice the weight, four to five times the piston displacement and six to seven times the power nevertheless gets gas mileage—with a manual box—two-thirds as good.

Service has always been one of the bugaboos of owning *some* brands of the little foreign cars. That's being mended. Mechanics are being trained for steadily expanding dealerships. Many dealers in Detroit cars are taking on a line or two.

The driver of a little foreign car has to put up with chaff from neighbors.

When I parked that Ghia in my driveway, the man next door yelled over, "*Was ist das?*"

I yelled back, "*Ein auto, you dope.*" Then I had an idea. "I'll have a Swedish car tomorrow," I added.

Sure enough, spotting the Saab the next day, he yelled, "*Vad are det?*"

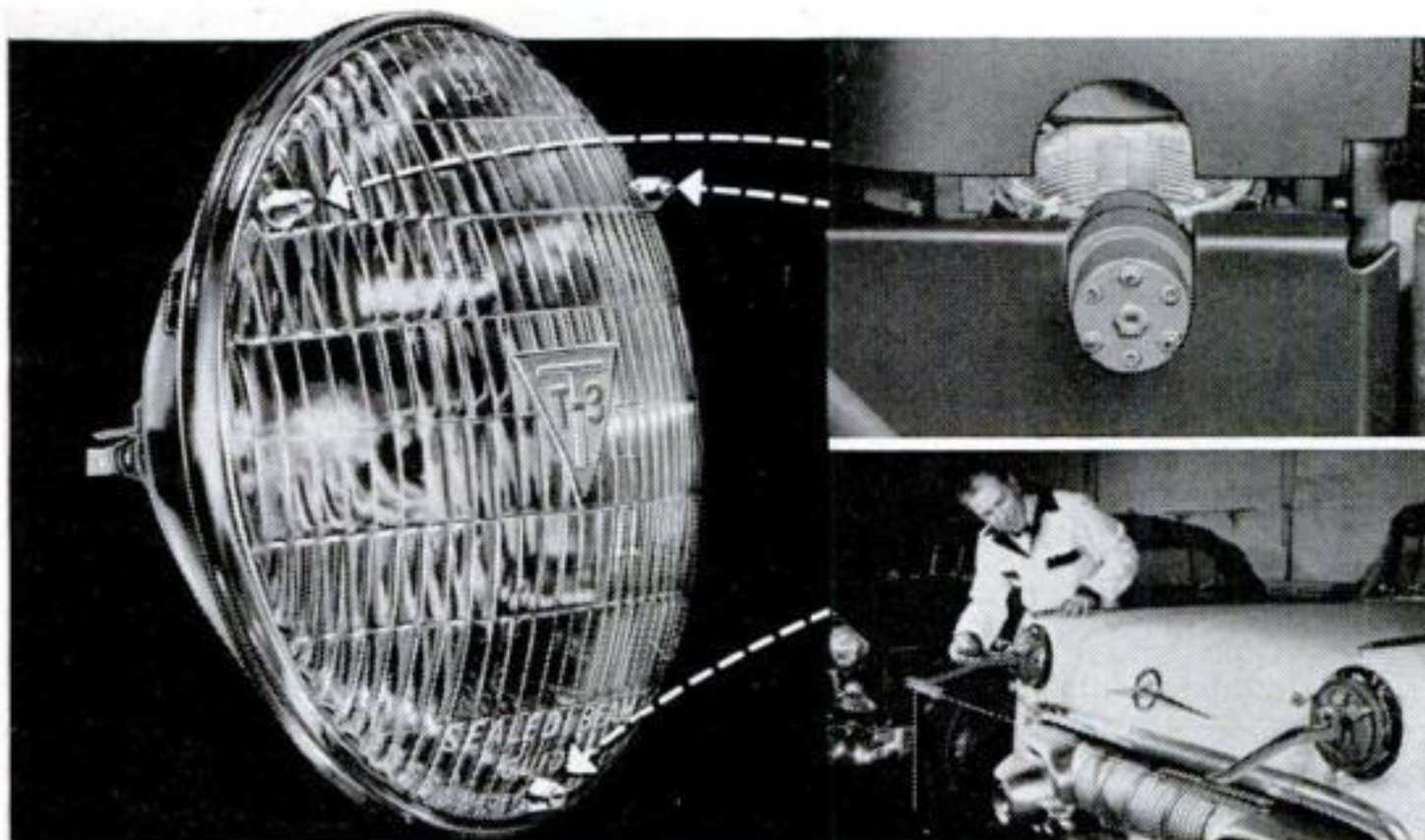
I yelled back, "*En bil, you dope!*"

I had located a Swedish-English dictionary, too.

END

GM **GUIDE**

goes one step further to give you the big difference in headlamps



In this Guide-developed machine each Guide T-3 Headlamp completes its assembly as follows. The light is turned on and when the exact beam center is automatically located, the machine electronically computes, memorizes and performs the necessary degree of "Guide Point" grinding to establish a perfect plane for Safety-Aiming.

Here, with only an ordinary screw driver, Guide T-3 Headlamps are being accurately aimed with T-3 Safety-Aimers that fit over the accurately placed and ground "Guide Points". This can be done in a few minutes in broad daylight—insures your really getting all the benefits built into these new Guide T-3 Headlamps.

***Exclusive electronically controlled process
is secret of Guide's extra aiming accuracy!***

Now, your car can have 20/20 vision for nighttime driving. With new Guide T-3 Safety-Aim Headlamps you get more light aimed right . . . on the right side of the highway, where you need it most!

A Guide-developed process permits Guide to gem-grind three precisely located aiming points on the lens of every headlamp. These "Guide Points" are accurate within one ten-thousandth of an inch—providing the most accurate aiming plane in the industry.

You get safer, more relaxed, pleasanter motoring every night you drive with Guide! It's a proven fact that nighttime driving is the most tiring and dangerous. So, give yourself and fellow motorists all the benefits of more light aimed right from a new pair of Guide T-3 Safety-Aim Headlamps. Your nearby AC dealers can install and aim them in a matter of minutes, day or night.

Relax . . . go Guide . . . tonight!

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

GUIDE

T-3

Safety-Aim

HEADLAMPS

**BUY IN PAIRS
WHERE YOU SEE**



JUNE 1957 205

Success Without a College Degree

[Continued from page 90]

Technical Institute (Portland, Ore.), Northwest Television and Electronics Institute (Minneapolis). Tuition: \$500-\$600. Admission requirements: Usually none, but high-school diploma for some. Time in training: one to three years.

Company schools. Many big corporations operate excellent institutes, and a few award formal engineering degrees besides training draftsmen, tool-and-die makers, designers, etc. Typical ones: Chrysler Institute of Engineering (Highland Park, Mich.), Brown & Sharpe Institute (Hartford, Conn.). Tuition: Usually very low. Admission requirements: High-school diploma with fairly good grades, and in some cases, a job with the company. Time in training: Up to two years for full-time study, four years for evening classes.

Correspondence schools. There are few subjects that cannot be studied by correspondence. But evaluate your child carefully. Does he have the self-reliance, work habits, and stick-to-itiveness to finish a course without the prodding of regular classes and instructors? The drop-out rate is high. Typical schools: International Correspondence Schools (Scranton, Pa.), National Radio Institute (Washington, D. C.), Commercial Trades Institute (Chicago). Tuition: About \$200-\$300. Admission requirements: None, but don't let your youngster sign up for a course for which he lacks sufficient background. Time in training: 120-150 separate lessons.

Military schools. The armed services now give more training in the skilled trades than any other part of the country's educational system. (The Army alone operates 127 schools.) If your son is eligible, he can get a written guarantee that he will be sent to school after enlisting. Armed Forces courses are short and intensive, and are not substitutes for civilian training. But they can give your boy a good start. Typical schools: Ordnance Automotive School (Aberdeen Proving Ground, Md.), Electronics Training Center (Keesler Air Force

Base, Biloxi, Miss.). Tuition: none. Admission requirements: High-school diploma, plus special examination. Time in training: six to 12 weeks.

University extension schools. These are classes sponsored (and staffed) by

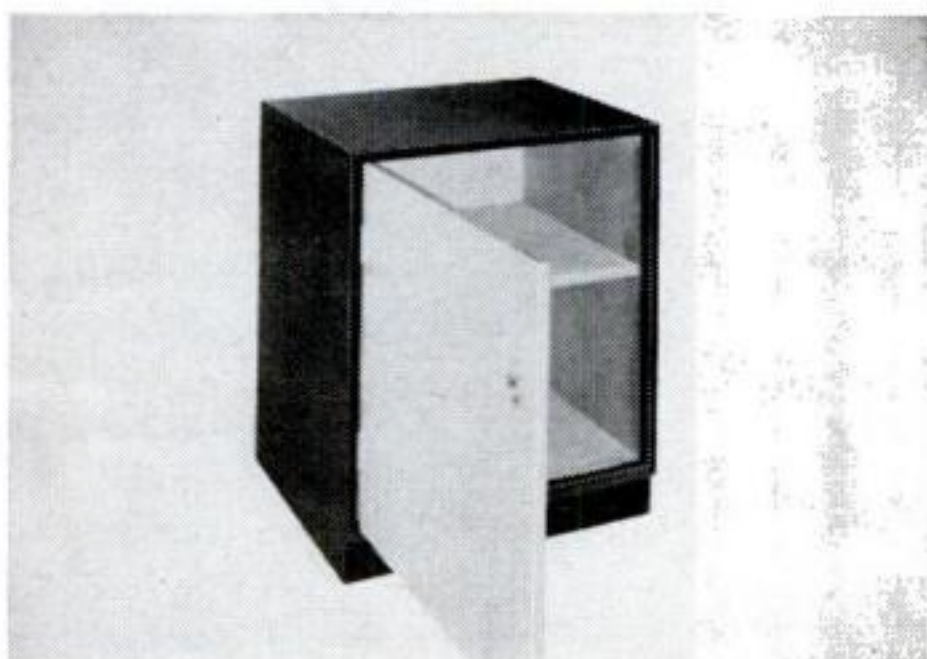
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: POPULAR SCIENCE's series of Straight :
: Talk to Parents will help you solve :
: the toughest problem of them all: :
: Which career should your youngster :
: aim for? :
: How can you tell what a child wants :
: to do when he grows up? Can you :
: match his preferences to his abilities? :
: Which of the thousands and thousands :
: of jobs in the U.S. today are the really :
: good ones? What fields are expand- :
: ing? Where is there likely to be high :
: pay and fast promotion? July POPULAR :
: SCIENCE will answer these questions :
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regular colleges. More than 150 universities offer them, in subjects usually linked to the needs of local industries. Boston University, for example, teaches ocean transportation, wool textiles. These aren't available at New York University, but color TV circuitry, plumbing theory and paint technology are. Typical schools: University of Illinois (Urbana, Ill.), University of Georgia (Athens, Ga.). Tuition: Usually low, but may range up to about \$50 a course. Admission requirements: Vary with the course. Time in training: Up to two years.

Adult education. There are 6,033 public-school districts in the U. S. that offer evening courses in their regular school buildings. You'll find the most useful subjects—auto maintenance, woodworking, carpentry, stenography—but the classes meet only once or twice a week, so the training cannot be intensive. Tuition: Very low. Admission requirements: None. Time in training: One year (normal course).

[Continued on page 208]

New Pine Plywood helps you add storage space to your home



STORAGE CABINET only 29" high—but with over 5 cubic feet of storage space! Has an adjustable shelf. Ideal for records, linens or as a base for desk or dressing table. See coupon for easy-to-follow plans.



SLIDING-DOOR CABINET is 4' long, 2' deep, has adjustable shelves. Ideal for linen, china, clothing, etc. Complete plans and step-by-step photos in new booklet. See coupon for your copy.

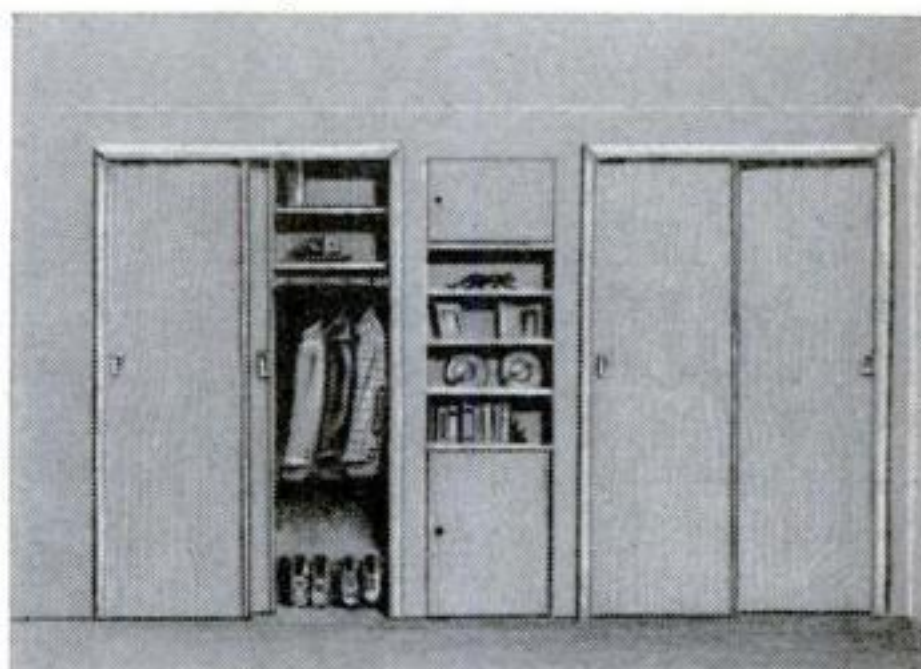


EARLY AMERICAN HUTCH gives you plentiful storage space in a handsome, conversation-provoking cabinet. Has drawer, handsome planter box, over 6 cubic feet of storage space. See coupon.

Weldwood Old Craftsman makes the job easy because it's the easiest working, easiest painting plywood ever!

Cramped for storage space? Here are four ways you can get it—easily. And although these projects are really "pro"-looking, they're not hard to build. The reason: they're made with Weldwood Old Craftsman Pine Plywood according to easy plans (see coupon). Old Craftsman Pine combines all the advantages of top grade pine lumber with all the advantages of rugged plywood construction.

Old Craftsman Pine Plywood paints better, saws cleaner, machines more quickly and sands smoother. Comes already factory-sanded! Available in panel sizes from 3' x 6' to 4' x 10'. Thicknesses from 1/4" to 1-13/16". See Old Craftsman at your lumber dealer's soon.



BUILT-IN CLOSET converts the wall at one end of your room into two 6' x 30" closets plus four open shelves and two swinging-door cabinets. See coupon for plans.



PINE PROJECT BOOK

UNITED STATES PLYWOOD CORPORATION
Box 61, New York 46, N. Y.

Please send me your book "Projects You Can Build With Weldwood Old Craftsman Pine Plywood." I understand it contains the 4 projects shown on this page plus 14 others. I enclose 25¢. PS6-57

NAME.....

ADDRESS.....

CITY.....STATE.....

Success Without a College Degree

[Continued from page 206]

Schools for nurses and medical technicians. These are almost always part of large hospitals. Courses are tough, career prospects excellent. Typical schools: Bellevue School of Nursing (NYC), Provident Hospital (Chicago). Tuition: From nothing at all to \$500. Admission requirements: High-school diploma. Time in training: Two years for technicians, two or four years for nurses.

Junior colleges. There are now more than 600, and the number is increasing rapidly. Most train students for such positions as engineering aides, draftsmen, designers. Typical ones: Joplin Junior College (Joplin, Mo.), Wright Junior College (Chicago). Tuition: From nothing to about \$200 for public colleges, up to \$500 or more for private colleges. Admission requirements: High-school diploma and, in some cases, good grades. Time in training: Two years.

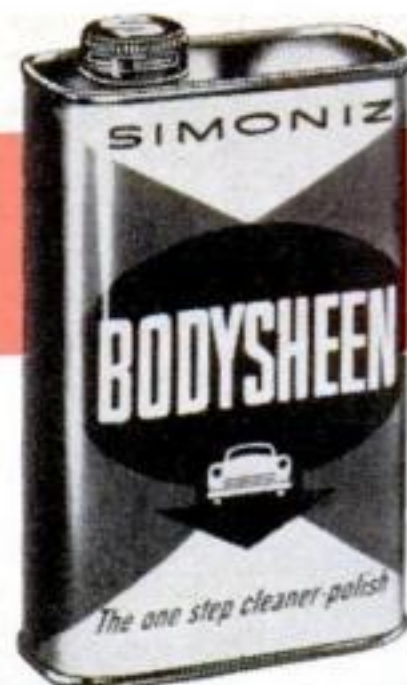
Which school? Some things are taught by several types of schools. There is an important difference here. For technical jobs, practical experience counts. So a technical institute or junior college with a good shop or laboratory might be the wise choice. However, if your youngster is studying part-time and already working in his field, he may need to learn only the theory, which he could get from a correspondence school or extension course.

The quality of individual schools varies widely, of course. Most are reputable and efficient. A few are little more than diploma mills.

Investigate thoroughly any institution your boy or girl wants to attend. Write to the department of education of the state the school is in, consult anyone you know in that occupation, and, if possible, take your youngster to visit the place.

Most important, get the best advice you can from local experts. That includes the guidance counselors, principal, and other teachers at the high school as well as admissions officials and professors at nearby institutions of higher learning.

END



One step - cleans, polishes!

Just wipe on new Simoniz Bodysheen, then wipe it off to give your car a tough, long-lasting, weather-resistant finish. No more hard rubbing! Brings out natural brilliance, enriches colors! (3P7113).....\$1.49

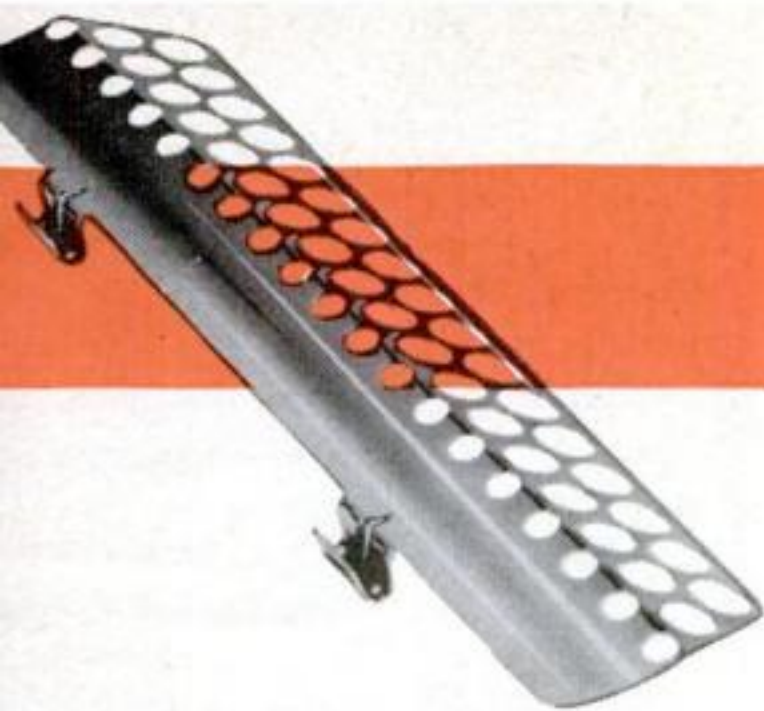


Entirely new kind of wax!

Vista, made by Simoniz, is a new turbo-whipped cream wax that cleans and waxes in one easy application... yet gives cars the lustre and all-weather durability of a paste-wax job! 10 oz. can (3P7222)\$2.00



Wizard Tune-Up Kit makes it easy to "tune" ignition system. Complete kit with heavy duty points, condenser, rotor. Saves gas, makes car start easier, run smoother, perform better. Easy instructions. All popular cars. (L4815-32).. From \$1.15



New Wind Silencer clamps on door edge . . . breaks up air flow, carries it away from car body. No more annoying wind "roar" even with windows down! Chrome-plated, rust-proof. Easily installed. Fits most cars. (C1390).....Pair **\$1.79**



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PISTON RINGS

BEST IN NEW CARS! • BEST IN OLD CARS!

History's Most Fateful Weather Forecast

[Continued from page 76]

it might whip the front across England and clear the Channel by Tuesday.

8:00 a.m., June 4

A report flashed from Blacksod, Ireland: "Cold front expected to pass this station at noon."

The Americans were hopeful. The front was on the move. Now it could be watched closely as it passed the land-based weather stations.

But the Air Ministry and the Admiralty were dubious. The pressure was still dropping in the Scottish low. In fact, before nightfall on June 4, it was to drop to 976.8 millibars at Wick, Scotland, the lowest pressure recorded at the station in over a century. Agreed forecast: operations questionable on the morning of June 6.

9:00 p.m., June 4

The Americans were jubilant. During the day, they had watched the front sweep southeastward across England. They had seen the pressure behind it rise one millibar per hour for the past five hours. Krick yelled into the phone, "I'm positive it will push on across the Channel."

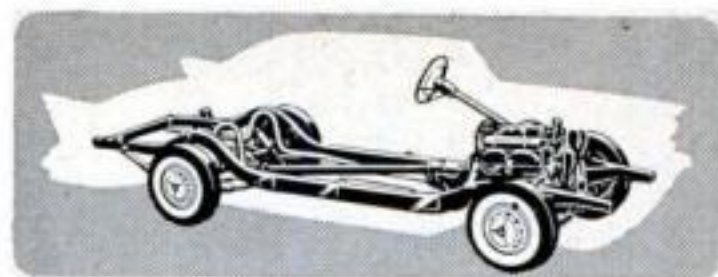
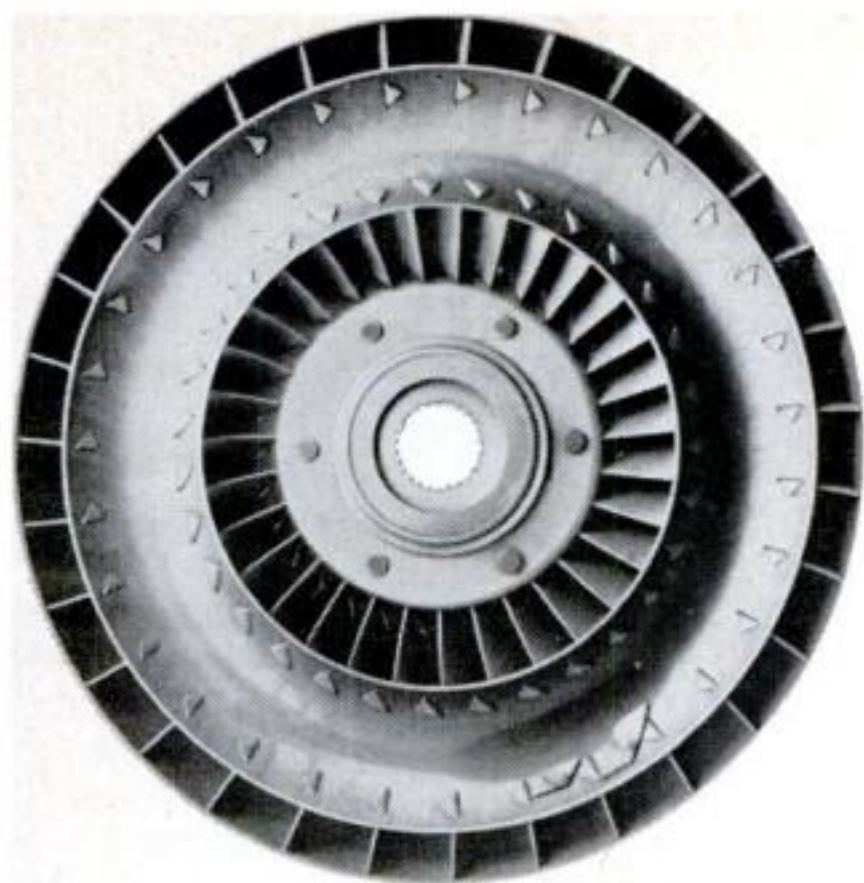
The Air Ministry was worried about the deepening Greenland low. During the day it had swept in rapidly behind the cold front. If it were to combine with the Scottish low, the weather would be far below the minimum for days, imperiling not only the actual invasion but the build-up of supplies behind it.

But the Admiralty edged toward the American view. The cold front was a strong one. It could dominate the Channel area. Forecast: Tuesday barely operational.

9:30 p.m., June 4

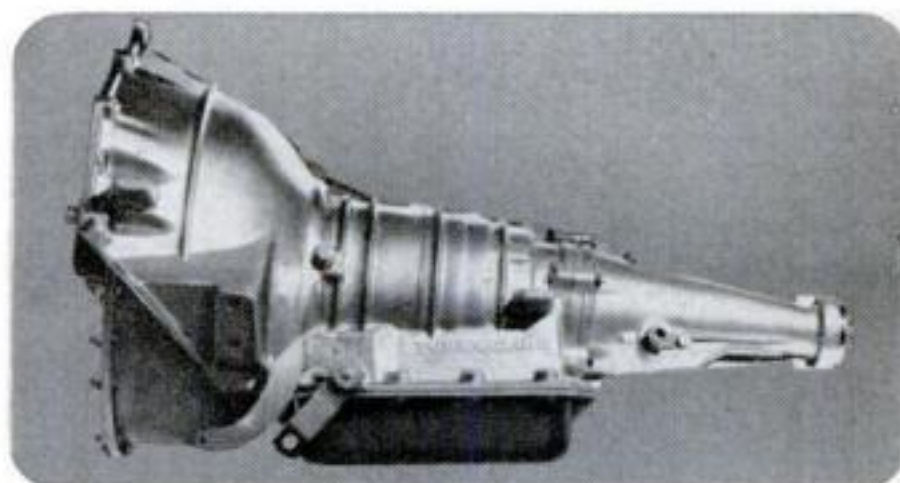
The wind blew strongly from the southwest. The air was damp. Low clouds scudded in from the Channel as they had for a week. But Stagg had a startling forecast: By 4:00 a.m. the next

[Continued on page 212]



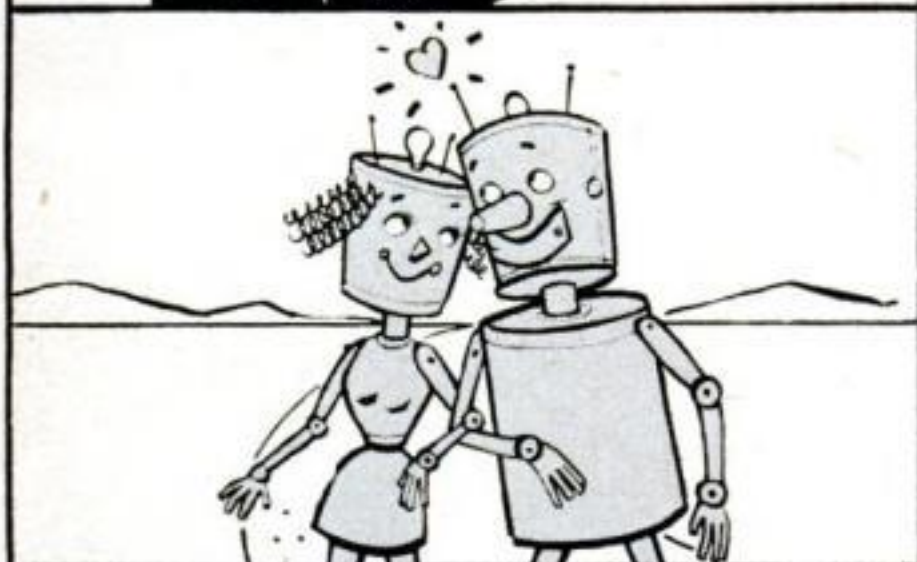
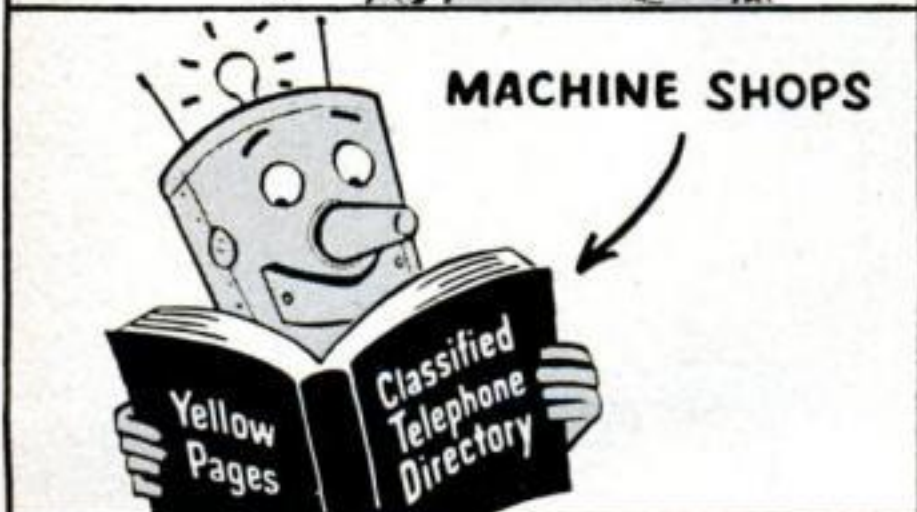
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TURBOGLIDE: forecast of the future



You don't have to look on the drawing boards—the answer is plain in any Turboglide-equipped 1957 Chevrolet. Here is tomorrow's drive, with an absolutely shift-free sweep of power, smooth as a plume of steam. Here is a quadrant that doesn't say "LO"—because there is *no* auxiliary planetary gear system needed. Here are *three* turbines for full-torque take-off, brilliant passing power and ultra-thrifty cruising. Here is the finger-flick Hill Retarder for safer slowing on grades . . . all this in a transmission that weighs 30 percent less than any other automatic drive (thanks to the largest production aluminum die casting in the world), with fewer parts, far fewer external openings and absolutely no delicate automatic shift valves. It's an engineering triumph—because it moves without a hint of mechanism. Try it and see! . . . *Chevrolet Division of General Motors, Detroit 2, Michigan.*

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History's Most Fateful Weather Forecast

[Continued from page 210]

day, a cold front would reach southern England. By 6:40 a.m. on D-Day (Tuesday), the cold air mass would contain no more than 5/10 cloud with bases at 3,000 feet. The wind would have veered to the west and dropped to 10 m.p.h. All elements but the heavy bombers would be able to operate. During the day the sky would become overcast briefly, then clear.

The Air Chief Marshals shook their heads: too risky. Eisenhower argued, "I'm quite positive we must give the order . . . I don't like it . . . But I don't see how we can possibly do anything else." He reserved his final decision until the next morning.

4:30 a.m., June 5

Only 26 hours before H-Hour, a northwest gale was howling across southern England, driving sheets of rain before it. The cold front was roaring through on schedule. In the War Room, Stagg managed a frozen smile. Dryly, he noted that his staff's forecast for that morning had been correct. Had Eisenhower gone ahead, it would have been a "catastrophe," he said. Then—"Last night's favorable forecast for Tuesday still holds."

Doubts gnawed at the commanders-in-chief, but if the forecast was correct, they could attack. They looked at Eisenhower. He nodded.

Within 15 minutes, the ships that had been rolling in the slashing rain in England's northern ports weighed anchor and started for the Normandy beach. Before they arrived, most of the men would be horribly seasick. The winds would continue to blow and the clouds to scud thickly at less than 1,000 feet.

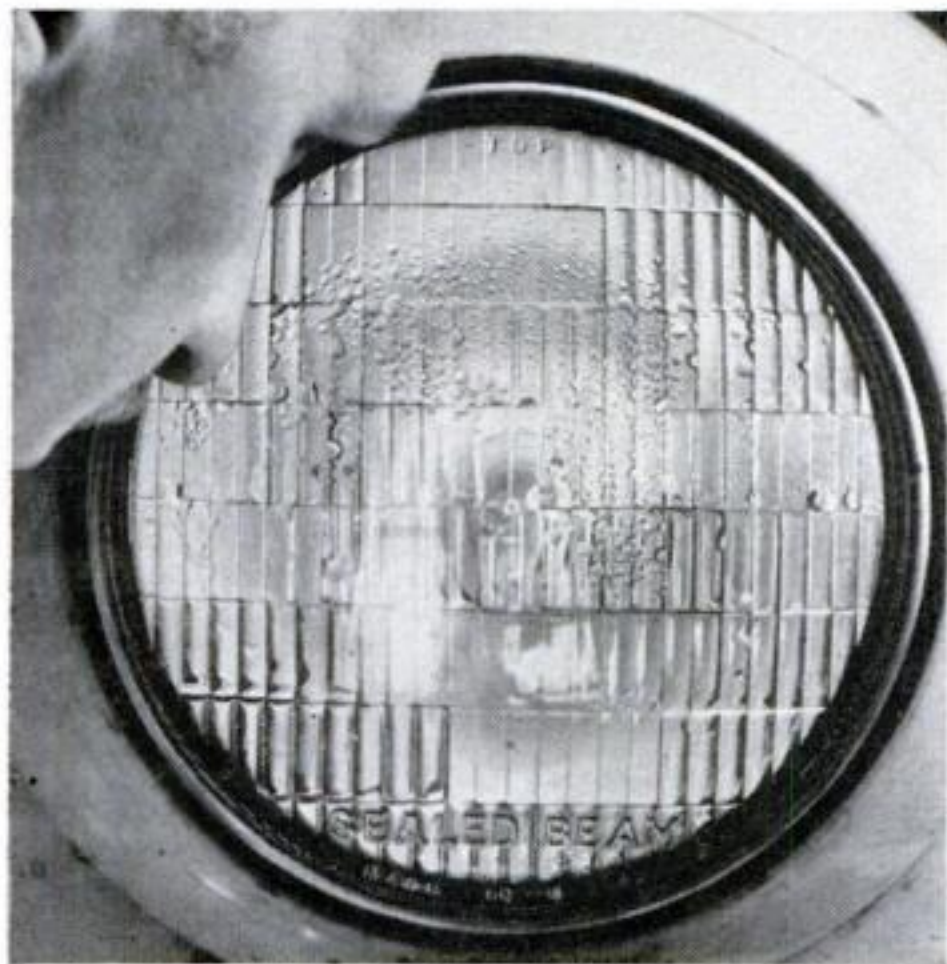
But it was clear. When the hundreds of ships and the quarter of a million ground troops converged on the beaches between Cherbourg and Caen at dawn the following morning, the weather had cleared briefly behind the front, and every branch of the service was able to carry out its assigned task with at least

[Continued on page 214]

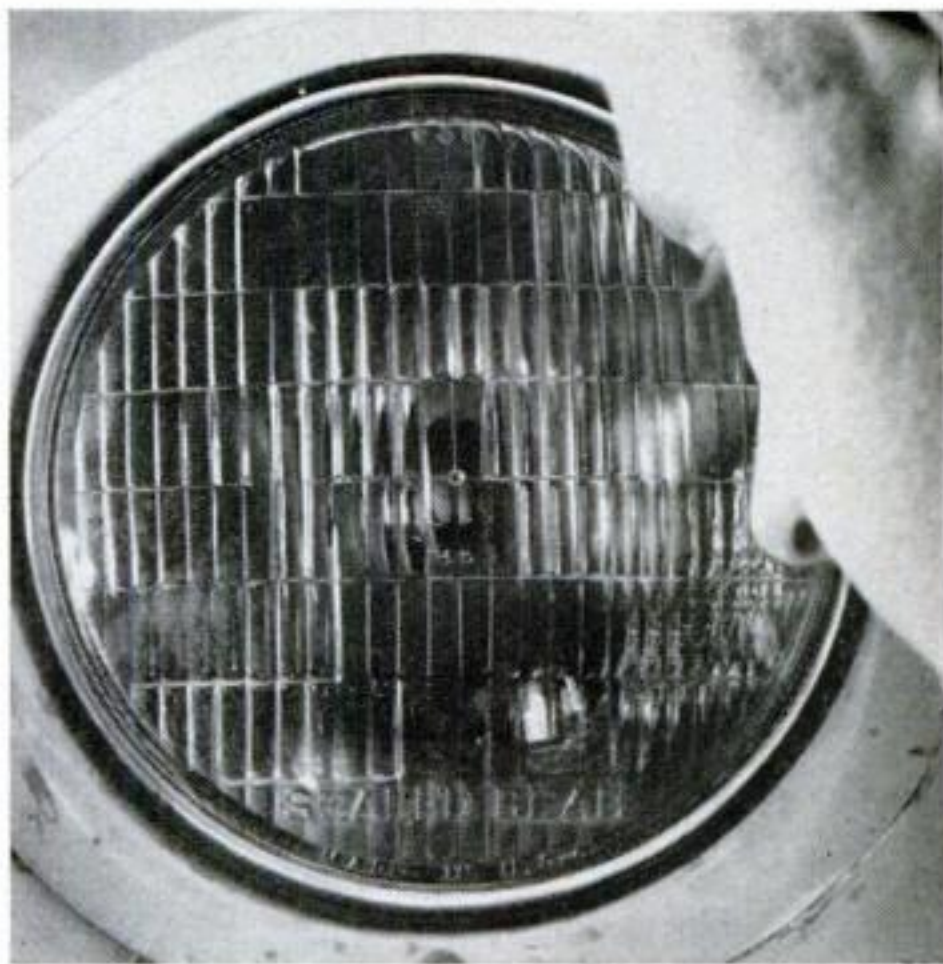
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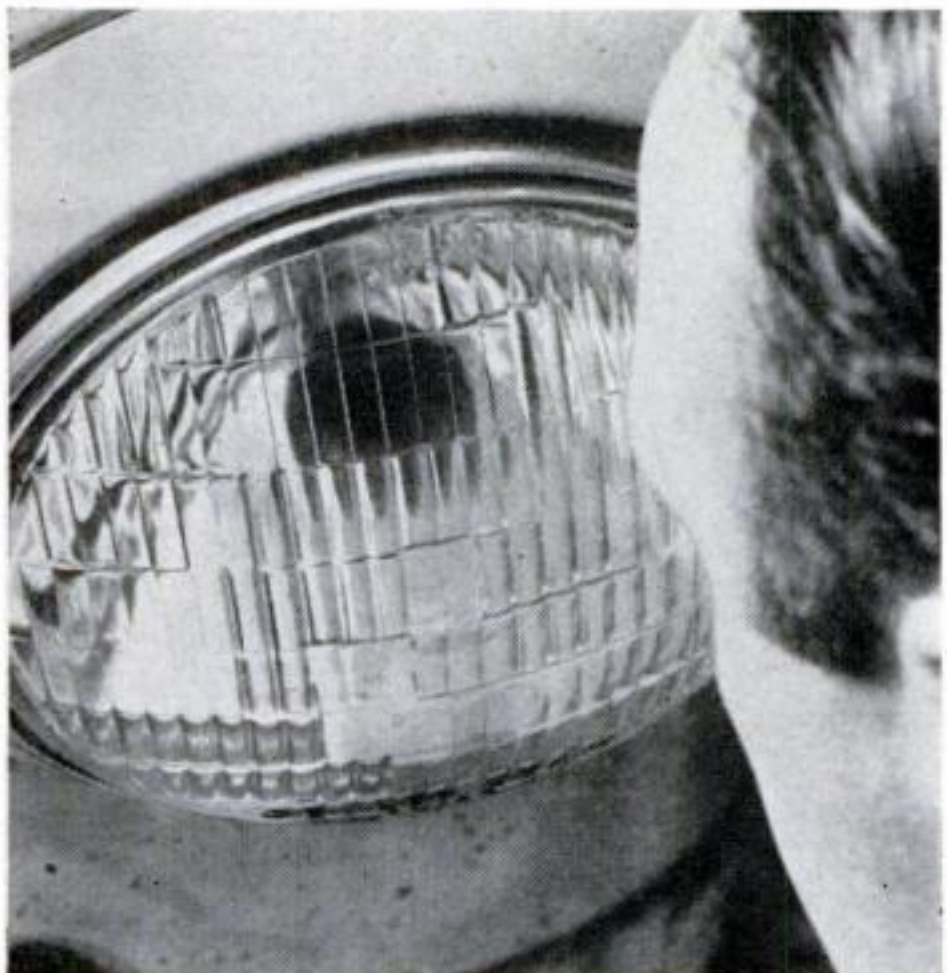
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Lower beam puts twice the light 300 feet ahead at the curb—You can see much better against the glare of oncoming traffic.

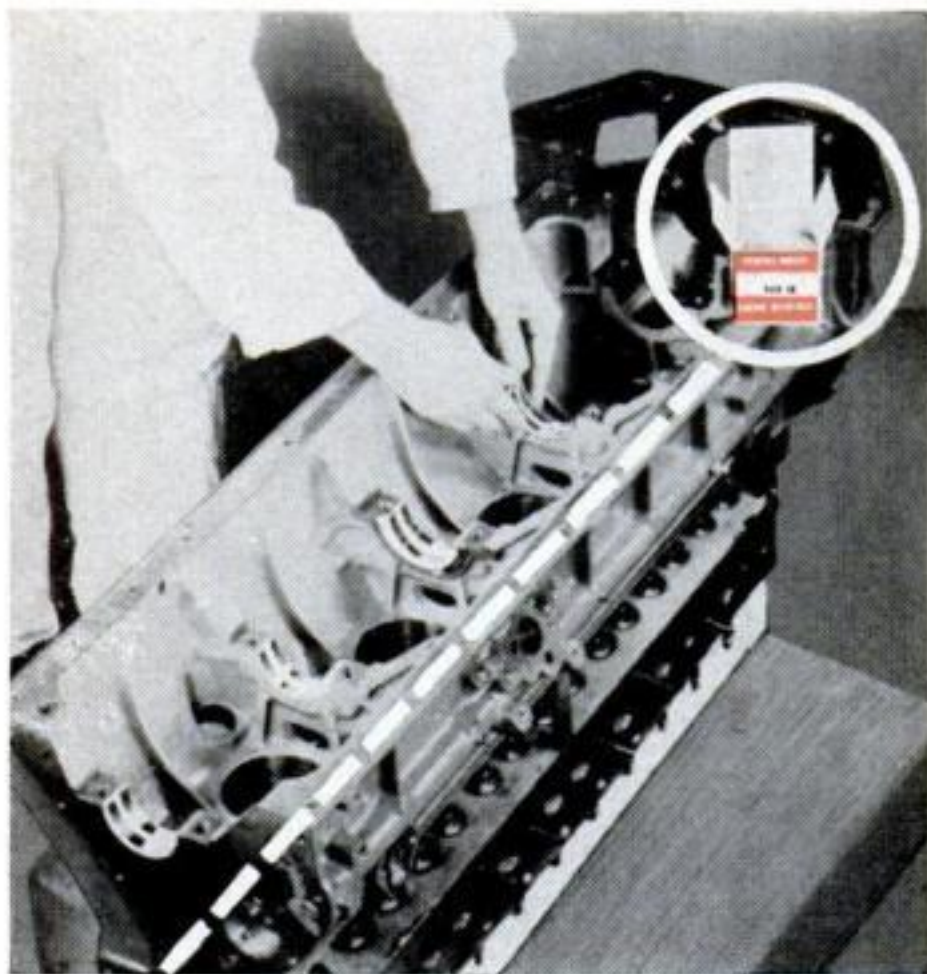
Upper beam that reaches far and wide—For open road driving, the upper beam filament is left unshielded to let you see curves, dips—even side roads.

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History's Most Fateful Weather Forecast

[Continued from page 212]

partial success—just as the six weathermen had predicted they would.

More important, when they hit the beaches, they met little opposition. Of Goering's 1,750 aircraft in northern France, only about 50 took the air to counterattack. Intelligence learned later from Maj. Heinz Lettau, a German meteorologist, that the enemy had been convinced that the Allies could not move while the weather was so unsettled. Most of Von Rundstedt's officers were away from their posts on leave or at exercises.

By noon on D-Day, the devilish Scottish low began to fill. That afternoon, it had almost disappeared and its trough swept southeastward through the upper air, clearing the sky of middle clouds.

The cold front continued on into

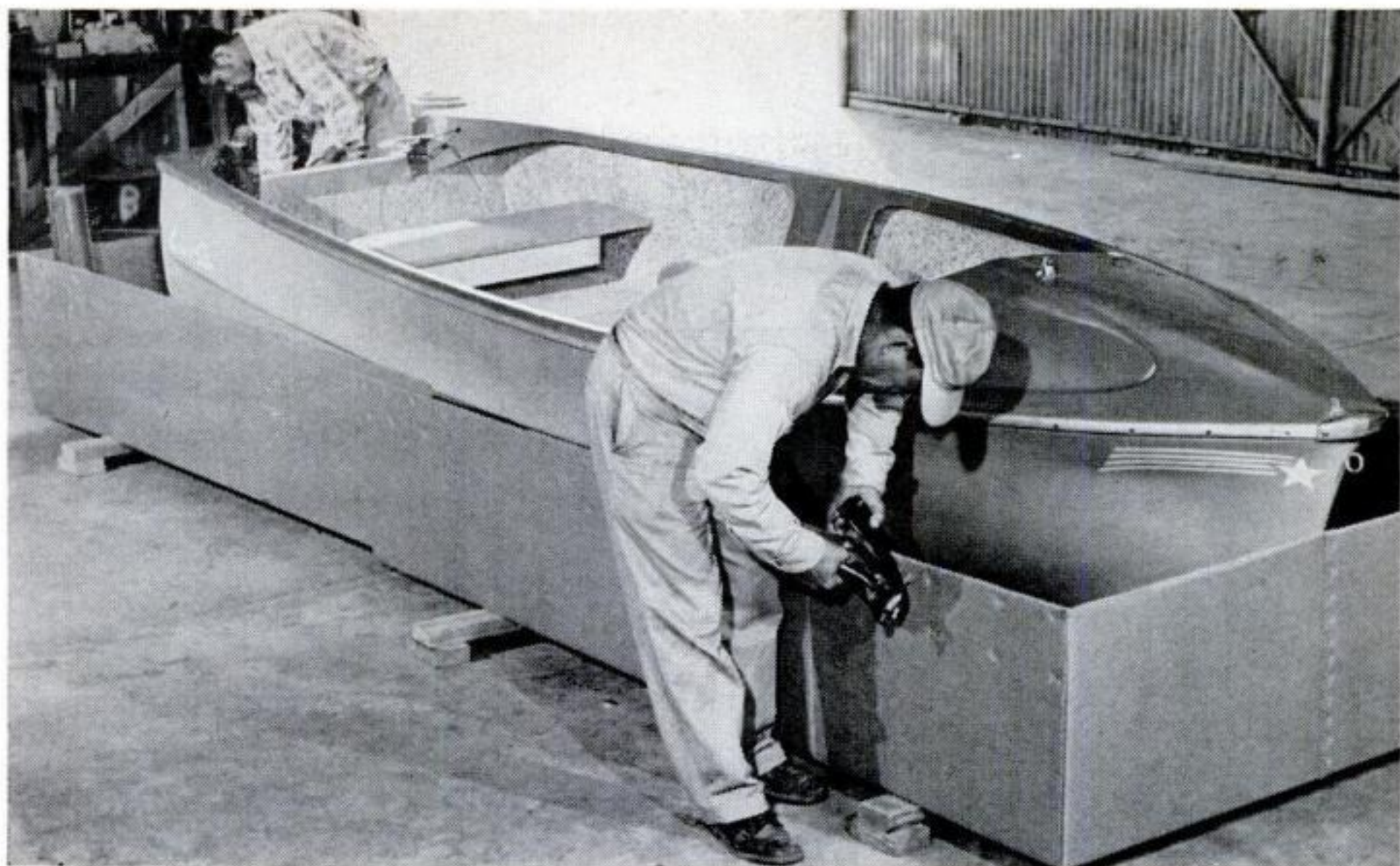
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NEXT MONTH: *The story of the Navy's F8U Crusader, the jet that lands on a pitching carrier in a "controlled crash."* Read: "The World's Meanest Flying" in July *Popular Science*.
.....

France where it rapidly warmed and dissolved, and the Azores loop finally reached out on June 7 to dominate the weather over the Channel.

Two weeks later, on June 19, the second choice for the invasion period, a "unique and unpredictable" northeast storm lashed all England. In rapid succession, a cold front, then a warm front (behind which the pressure remained abnormally high), and then another cold front swept over England and consolidated in the Channel area. Winds reached near gale force. Hundreds of small craft sank, dozens of troops lost their lives, and one of the huge artificial harbors on Omaha Beach was destroyed.

The disturbance moved in so quickly that it could not have been forecast in time to stop the invasion. The slaughter at sea and on the beaches would have been sickening.

But by that time, Eisenhower's biggest gamble had paid off. END



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Bouncing Truth Across the Iron Curtain

[Continued from page 93]

fan-shaped signal pattern into a concentrated beam. With this system, a 50,000-watt transmitter, equal to the largest used by standard U. S. stations, has an effective power of over two million watts.

"Wave-shaping" is still another method. The idea behind it is as simple as the mechanics are complex. You need a certain amount of power to transmit the entire range of the human voice. If you screen out the highest and lowest frequencies, and transmit only the middle range, less power is required. The voice is still intelligible, and the power saved can be used to boost the middle-frequency signal. The idea is not entirely new: It's the same method used in sending your voice over the telephone.

Just as the West has refined its techniques, so the Soviets have improved theirs. For example, it is known that early jammers were little more than radio tubes hooked up to antennas. A month after the Poles revolted, however, many jammers ceased operating, to be replaced by regular Polish broadcasting stations. From this, Western technicians have deduced that the Polish jamming stations had been built as elaborate broadcasting centers, easily convertible to voice broadcasting.

Inside the Soviet Union itself, jammers now identify themselves regularly with call letters. This indicates that they, too, are set up on a permanent basis.

But the jammers are fighting an uphill battle. For, with the help of the Heavyside layer, Western information continues to pour into Russia and the satellites with enough regularity to have caused the Soviets to spend, so far, over one billion dollars—more than twice as much as the West has spent.

Every now and then, however, a jamming effort does turn out a complete success. On August 25, 1950, a Soviet jammer managed to drown out an important speech being transmitted over the United Nations radio. What the jammer did not realize was that the speaker was Mr. Malik, the Soviet delegate. **END**

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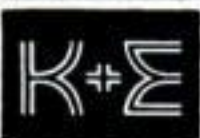


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New Missile Strikes Like Rattlesnake [Continued from page 125]

lake while from the rear seat a cameraman recorded the first "flight" of the Sidewinder.

Sidewinder was accepted as a Navy project in 1951. But it wasn't until Jan. 9, 1954—the same year Dr. McLean was named technical director at NOTS—that its guidance-and-control system, tested time and again, at last led it straight to its target. On that day, some seven years after Dr. McLean's work was begun, it struck down a B-17 drone. Navy officials were elated, especially when they learned that the missile had downed its target without the benefit of a warhead!

At the outset, Dr. McLean insisted that his missile should require no more handling techniques than needed for a five-inch shell. "It should work as simply as placing a cartridge in a gun and firing it," he declared. He accomplished just about that. The Sidewinder, now being produced by the Philco Corp. of Philadelphia, is delivered in three sections—the rocket (containing the solid propellant), warhead, and the forward guidance-and-control mechanism.

No technical knowledge is required to lock together the three sections and give it the flashlight check. No exhaustive, time-consuming tests, as on a radar-guided bird, are needed. The Sidewinder's "brains"—that is, the guidance-and-control mechanism—are factory-sealed.

This missile is known to have shot down a larger missile, probably a Matador. It is as effective at 60,000 feet as at sea level, performing in all weather from Arctic cold to torrid tropics. Its range is classified, for the discomfort of the enemy. It is aboard Navy aircraft carriers at this moment. Reliable sources say that certain Air Force groups—probably the Air Defense Command—also carry Sidewinders.

The missile's murderous efficiency may create new dangers. Dr. McLean admits that in the confusion of combat one of our own planes might become a Sidewinder's target. After all, it homes on

[Continued on page 220]

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.38 S&W COMMANDO
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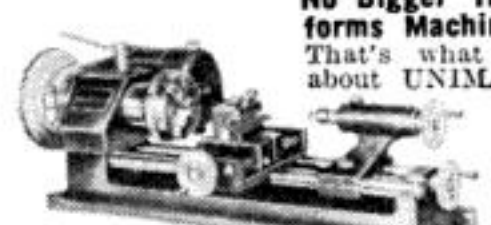
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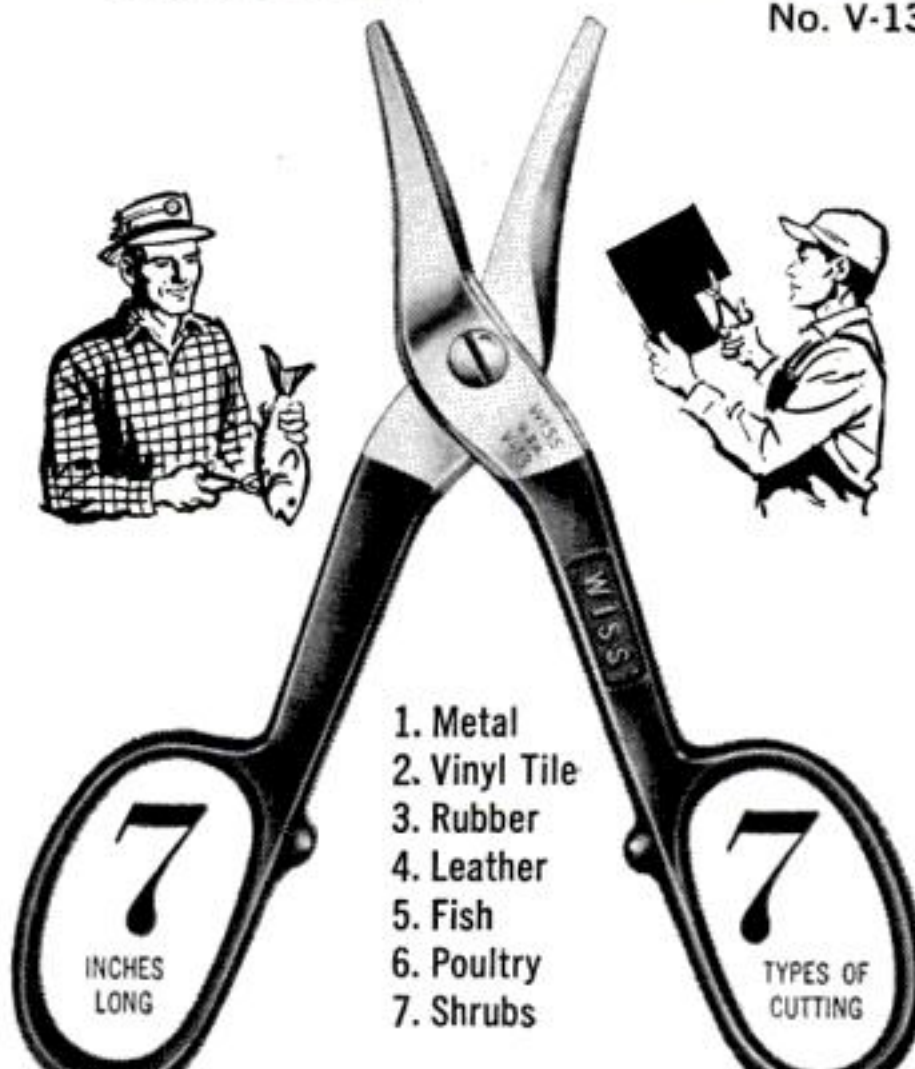
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New Missile Strikes Like Rattlesnake

[Continued from page 218]

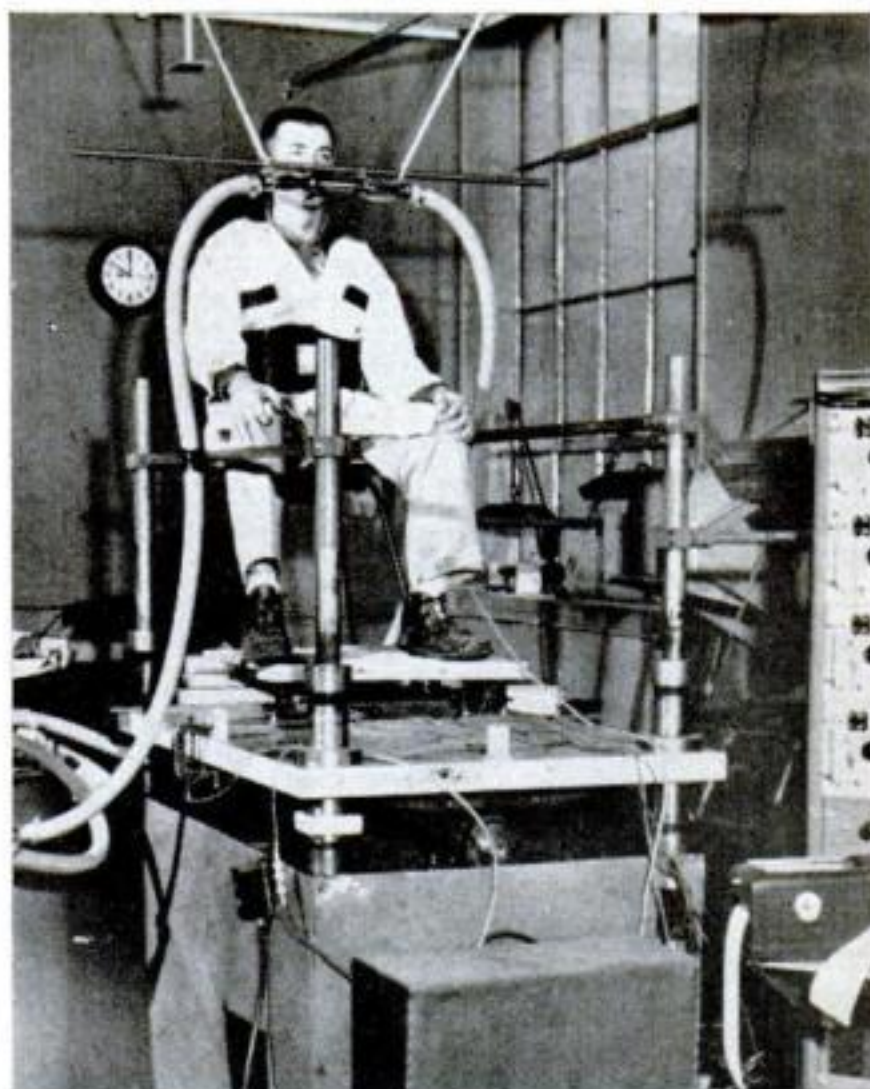
infrared, and it isn't fussy about the nationality of the source.

Scientists who worked on it say its development would have been impossible without McLean's imagination and ingenuity. The son of a Presbyterian minister, McLean obtained his doctor's degree in physics at California Institute of Technology in 1939. Then, in 1945, after helping to develop proximity fuses at the National Bureau of Standards, he came to NOTS.

Today, as NOTS director, he earns \$17,000 a year, a comparatively lean sum for a man with 4,900 civilian employees. Recently he was offered \$30,000 a year in private industry. He declined, explaining that he wished to remain where the most opportunities existed to help America remain powerful.

The Sidewinder, he hopes, is only the beginning. END

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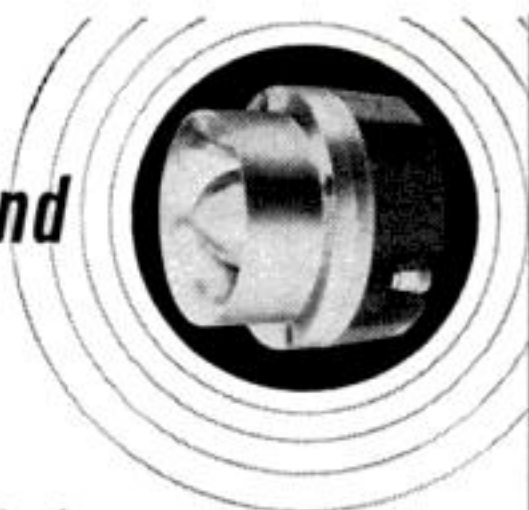


MILLERS FALLS COMPANY
Dept. PS-18
Greenfield, Mass.

This offer expires June 30, 1957

JUNE 1957 221

notes and quotes



loudspeaker logic for the newcomer to high fidelity PART II the extended range loudspeaker

The loudspeaker in your true high fidelity system is the component which generates sound. An alternating electrical signal from the power amplifier causes the loudspeaker cone to vibrate. The quality of your loudspeaker will largely determine the quality of the sound you hear. Independent authorities recommend that from $\frac{1}{3}$ to $\frac{1}{2}$ of your total investment should be budgeted to your loudspeaker system. Almost without exception they agree that you should begin with top quality loudspeaker components.



All dynamic loudspeakers have many parts in common. They are all made with a frame, a permanent magnet, a cone, and a voice coil. Yet the difference between the loudspeaker in your table model radio and a true high fidelity precision transducer is as great as the difference between a bargain counter alarm clock and a navigational chronometer. The difference is in design, in materials, and in precision craftsmanship.

It is possible with a single speaker, properly enclosed, to reproduce every note transcribed on today's excellent recordings. Such a speaker is called an "extended range" unit. James B. Lansing Sound, Inc., manufacturers of JBL Signature loudspeakers, produce several such models—each the very best in its class. Through advanced engineering design and precision craftsmanship they do make of... "every note a perfect quote."

JBL Signature speakers are made with large voice coils—coils with two to four times the diameter found elsewhere. In the 15" Model D130 Extended Range Loudspeaker, for example, the voice coil is 4" in diameter. It is made of hair-fine aluminum ribbon which is actually wound on its narrower edge. Magnetic circuitry is exceptionally refined. Frames are rigid castings. They are the most efficient speakers made anywhere. All of these features lead to the most lifelike reproduction of sound available. They are available from dealers who specialize in audio components. For the name of the audio specialist in your community, and your free copy of the JBL Signature catalog, send us your name and address on a card or in a letter.

every note a perfect quote

"JBL" means



JAMES B. LANSING SOUND, INC.

2439 FLETCHER DRIVE, LOS ANGELES 39, CALIF.

New Rafts Defy Sea's Worst Terrors

[Continued from page 131]

few men in a covered raft would keep them warm.

Other details provide against all possible emergencies the British have been able to find: There is concentrated food (including hard candy) for 20 days for every man a raft carries. There are inflated rubber cushions to sit on. Some rafts even have massage liniment.

Anti-seasickness pills are often provided in the rafts (even sailors can go green in them). Possible puncture of the buoyant air-filled compartments is provided for: There are seven separate air-containing compartments. Tests have shown the rafts will float and remain stable if half their air leaks out. There is also a plastic to plug any holes, and a bellows to refill any empty compartments with air.

ALL THIS means the life rafts are as completely equipped as lifeboats have ever been. How completely is shown by a final touch: A shark repellent may be carried in seas where it is needed. This consists of a handful of crystals you drag behind the raft in a bag. As a result, like the octopus or squid, you squirt an inky fluid that blinds a shark and his pilot fish.

By 1956, the British had enough new rafts to start installing them on their vessels. The real tests, they knew, would come in 1956-7 on the North Atlantic. This sea of missing ships could be depended upon to furnish plenty of storms and disasters. It did:

When the trawler *Osako* sank, the *Thessalonian* rescued every man—in two rubber rafts. There was no difficulty in launching or boarding the rafts, crews of both ships said later. Those who rode the rafts said their motion was very easy. They praised the way the raft bounced against a vessel without damage where a lifeboat would have been stove in. In the future, they said, they would prefer rafts to lifeboats.

In a collision, the *St. Celestin* was

[Continued on page 224]

Handy Nail Guide

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- Tells amount of nails per pound
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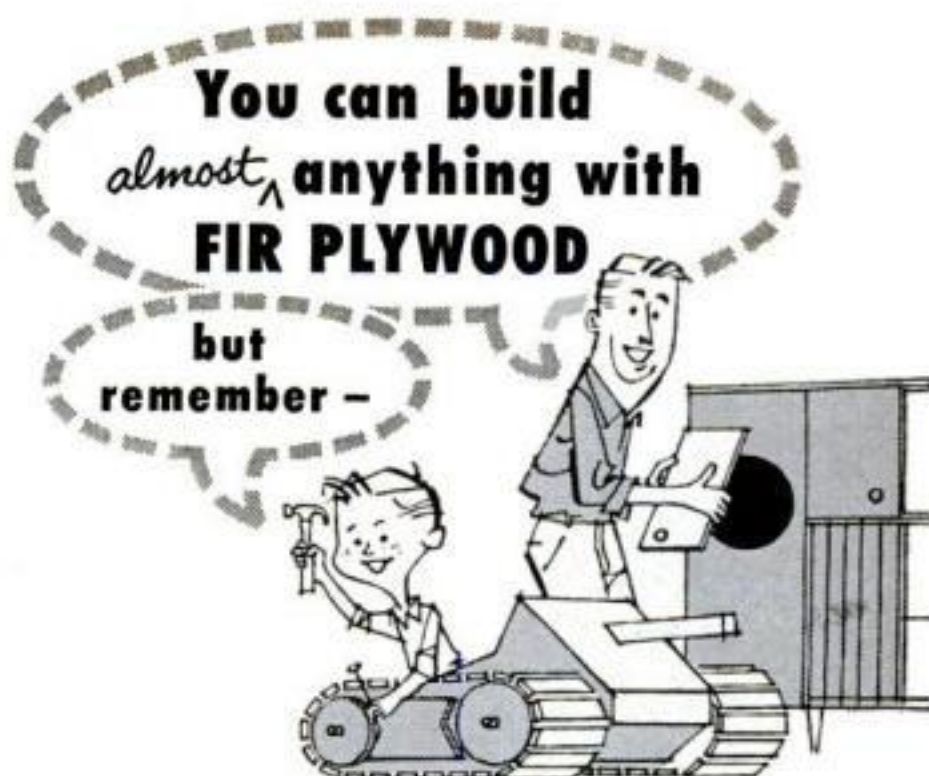
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FAN KIT Company

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Memphis, Tenn.

New Rafts Defy Sea's Worst Terrors

[Continued from page 222]

nearly cut in two and began to sink immediately. Two of the crew picked up a 10-man raft, jerked the cord, and bundled it over the side. Sixteen men leaped directly onto the raft—before it had completely inflated itself. The other three hung onto the lifeline around the raft's side. It supported them all. The men were quickly picked up by two vessels standing by. The raft got credit for saving them: Some of them, like many sailors, could not swim.

BUT the outstanding example, perhaps, to show what a raft could do, was that of the Jane Jorgensen.

The Jane Jorgensen sank during heavy going in the North Sea. Her crew launched their brand-new raft and, as their decks went down beneath their feet, stepped into it. In addition to the emergency pack already aboard the raft, they took along blankets, extra food, and playing cards.

They were picked up alive, warm, dry and unhurt after 15 hours. They were, they said, comfortable despite the gale waves. They had simply spent the time sleeping or playing cards. A lifeboat, they thought, would never have brought them through the storm.

The standards for lifeboats carried by transoceanic liners are set by the International Convention for Safety at Sea (1948). The British now advocate that the new life rafts be required for the liners. The U. S. Coast Guard backs the recommendation.

THUS liners may become safer than ever. Their appearance may also change: Lifeboats, carried by ships for hundreds of years, may go into limbo.

But the most significant thing about the rafts is this: They promise that in the future there will be fewer tragic stories of missing ships lost, like the Nordic Star, with all hands. Instead, there will be happier endings, where up to 100 percent of the crew survives. As in the case of the Jane Jorgensen. **END**

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4"x6" Base
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Those Deadly Highway Ghosts

[Continued from page 121]

appearing before a driver, can be fatal.

Road hallucinations are not really new. The hallucinations are as old as the Greek words, meaning "leading into sleep," from which the word "hypnagogic" comes. The ancient Greek philosopher Aristotle mentions them. The distinguished 18th century German poet and scholar, Goethe, acknowledged that once, when he was riding horseback out of Strasbourg: "I saw, in my mind's eye, my own figure, riding toward me, attired in gray with gold lace."

According to the professor, Goethe's experience is not characteristic of highway hypnosis, because a person appeared. Auto drivers usually see only animals or objects.

"The driver, you remember, wants that subconscious reason to stop," Prof. Moseley explains. "He knows that people won't stop him because they will get out of his way."

PSYCHOLOGISTS say there is a difference between an illusion and an hallucination. One having an illusion actually *sees* an object, but interprets it as something else. Readers of *The Legend of Sleepy Hollow* recall that Ichabod Crane fled screaming when a disembodied head came flying at him in the night. The next day, neighbors found only a shattered pumpkin. One having an hallucination, however, sees no external object at all. He creates the image, usually to satisfy a need; in the tired driver's case, it is the image of a road barrier. A desert mirage is evoked by another strong need—for water.

Treacherous as it is, hypnosis on the highway will not, by itself, bring on hallucinations, Prof. Moseley insists. A road trance may make a driver more susceptible, but it is exhaustion that triggers the image.

A STUDENT at the Michigan State University said he often fell into a hypnotic trance while driving the 80

[Continued on page 228]

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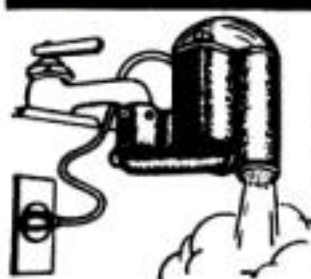
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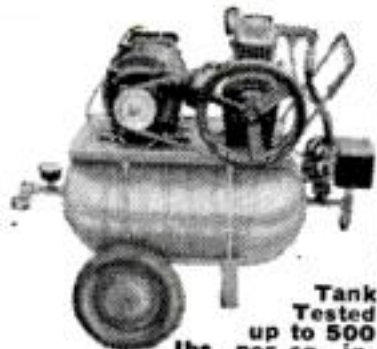
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BIG 1957 Catalog

Those Deadly Highway Ghosts

[Continued from page 226]

miles between his home and the East Lansing campus. He said he drove "automatically" many of those miles. "I would find myself coming to—doing 50 miles an hour—and not remembering anything for as far back as 15 miles," he remarked. "I discovered I had gone through three or four small towns without even recalling one stop light."

In another aspect of this trance, says Prof. Moseley, a motorist may look at the number "45" and not realize that it is a posted speed limit. A red traffic signal may mean nothing. The motorist may even drive up to a flashing stop light at an intersection and sit there, waiting for it to change.

"I have talked with drivers who say they have gone through an area completely familiar to them and not recognized it," the professor reports. "Again, they may become bewildered and wonder where they started from and where they are going."

BIG money and big talent are investigating these psychological dangers, with a number of national transportation and safety organizations taking part. You can take comfort in knowing that science rides with you, uncovering the causes of highway ghosts and offering advice on how to protect yourself.

Road engineers are also working to eliminate the causes of highway hypnosis. The Indiana Toll Road, one of the nation's newest super roads, has a gradual curve at least every two miles to help keep motorists alert. The Indiana Toll Road Commission thinks that with their road's concrete driving surface and blacktop shoulders, a hypnotic driver probably would be awakened the moment he veered onto the rougher shoulder. With the same thought in mind, the Ohio Turnpike Commission made its road undulating, and varied the width of the center strip and the type of landscaping. The Ohioans also erected colored reflector signs to stimulate drivers mentally.

[Continued on page 230]

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Those Deadly Highway Ghosts

[Continued from page 228]

At Iowa State College, engineers say that trees, planted at various distances from the highway, will help break the monotony of the scene and will also vary the sound of passing vehicles. A "singing" curb, which gives off a weird noise when touched by a tire, has been developed. Bridge rails have been designed to whip back startling echoes to catch the driver's attention. Some engineers urge the use of coarse pavement to make louder traffic noises, warning of approaching intersections and communities. Rainbow-hued pavement has been suggested to excite the motorist's interest.

WHILE Prof. Moseley agrees that highway designers can do much to take monotony and boredom out of driving, he thinks that designers of the autos themselves can help. There is too little work involved in handling today's car, he believes. Power brakes and power steering, for instance, make it easier for a driver mechanically, but not psychologically. Placing the brake and accelerator so the driver could use either foot would allow for more exercise.

A number of safety engineers criticize the limited visibility in the low-slung modern cars, which they assert may lull the motorist to sleep.

All-night radio stations around the country are joining in the battle to keep drivers awake. Early-morning disc jockeys, report that they receive letters from travelers asking them to play lively music, instead of slumber melodies.

OTHERS suggest that stations broadcast periodic warnings about driver fatigue and notes on road conditions.

Police officials emphasize that they can do little about motorists who let themselves reach the hypnotic state. The patrols can only caution that drivers, before they set out, learn what the dangers are and be on guard. Motorists should study their trip "geography," arrange a reasonable day's driving, and not be tempted to travel farther. **END**

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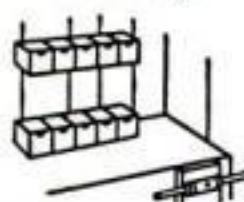


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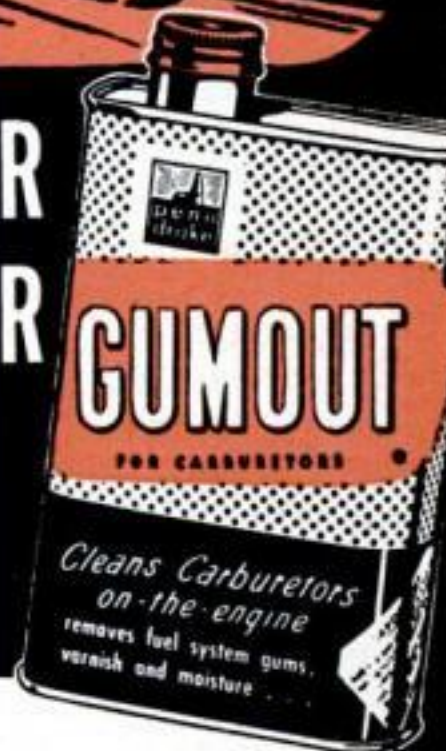
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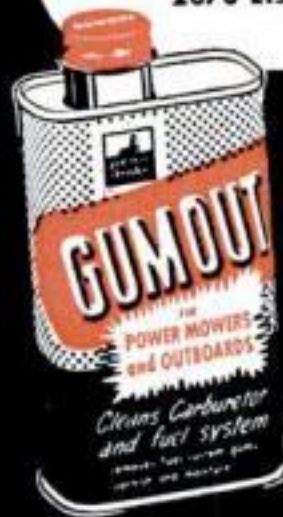
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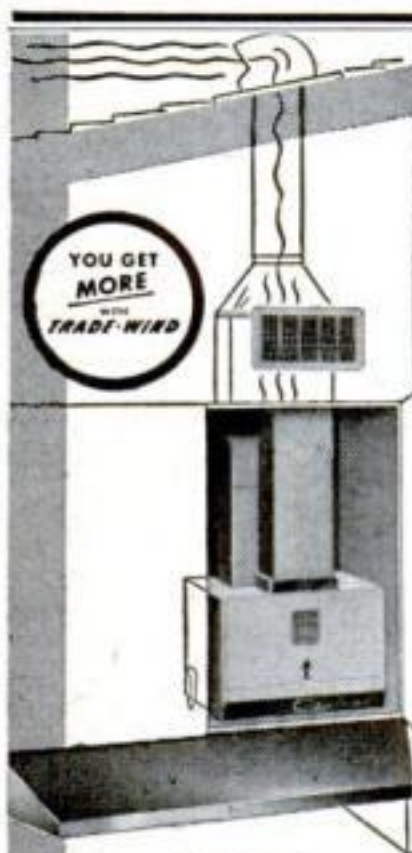


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Look What They're Doing to Batteries

[Continued from page 80]

receivers tuned to the individual wave length. When there's a call for one of these doctors, the switchboard operator dials a number opposite his name on a transmitter set, and an impulse causes his receiver—and his only—to buzz. He then goes to a phone to receive the message.

For paging systems in noisy factories, Motorola makes a radio powered by a single mercury battery, with an earplug attachment. Batteries are also used to power new wire recorders small enough to be concealed in pocket or purse—of great value to reporters and for secret intelligence work.

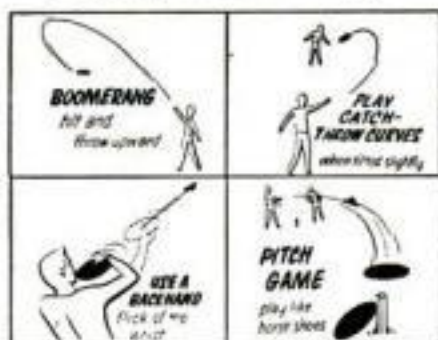
Most intriguing of all new motor-action applications of dry cells is in Bell & Howell's new 16-mm. camera which has an electric eye in the true sense of the word. A photoelectric cell, as in an exposure meter, reads the amount of light in the area toward which the camera is pointed and transmits the information to a battery-powered motor which, through a train of tiny gears, opens or closes the lens—just as the pupil of the human eye contracts in bright light and opens in shade. The power comes from six small mercury cells, three of which drive the motor in one direction, three in the other.

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[Continued from page 234]

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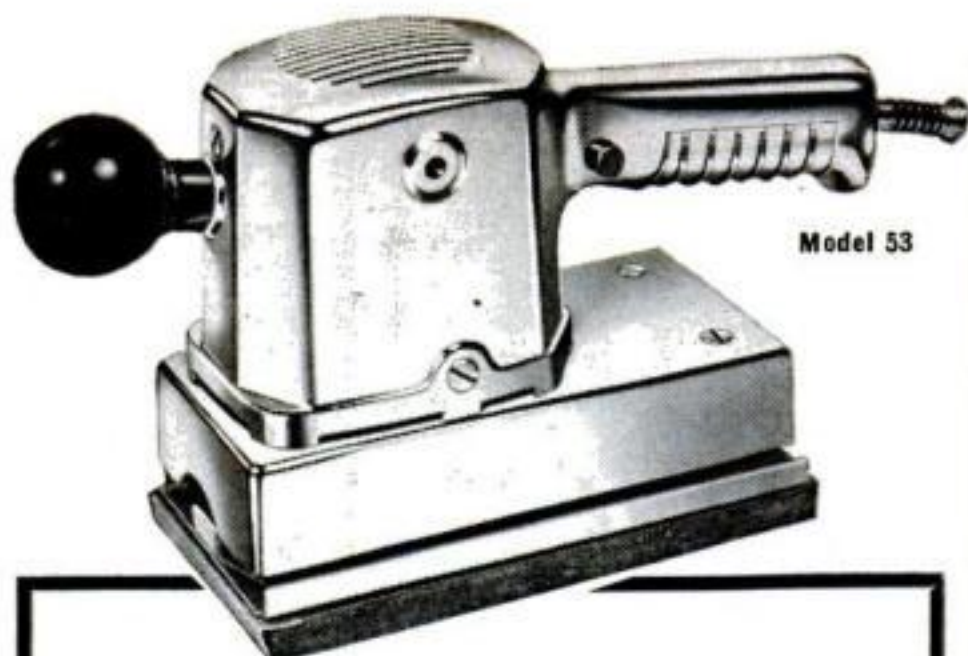
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Look What They're Doing to Batteries

[Continued from page 232]

even work when placed under water.

And for use in gas-filled mine explosion areas, the U.S. Bureau of Mines now has a portable rescue telephone system with a 2.8-volt transistor that can't generate dangerous heat or sparks.

"Shocking" devices, too, are battery powered—which surprises some people because you don't feel anything when you touch a dry cell. But batteries can be used to set up an "electric screen" in water, which will repel but not injure fish and thereby control their movements. Such screens are used to prevent fish from entering irrigation canals; to keep them out of water-supply intakes; and to keep lamprey eels out of the Great Lakes. On the range, an ordinary six-volt dry battery with a simple voltage step-up device will supply current over as much as 15 miles of single-strand wire fence, capable of shocking and discouraging wandering cattle.

Radically new kinds of batteries are being built, with commercial uses still unrealized because they have been developed for special and usually secret military purposes. There is, for example, the first literally *dry* battery—only 1/35 the size of a flashlight cell but with 60 times the voltage and a projected storage life of more than 20 years. Such a battery is ideal for maintaining a long-term charge on capacitors in electronic circuits which need to stand by in readiness for years at a time, as, for example, in remote radiation and fire-warning devices. Important, too, is the fact that this battery can operate in a temperature range from 70 below to 170 degrees above zero.

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[Continued on page 236]

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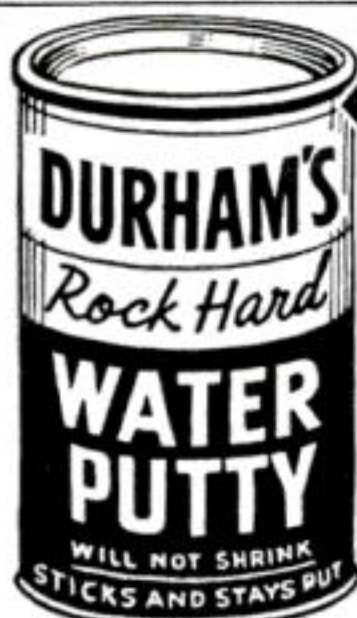
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Look What They're Doing to Batteries

[Continued from page 234]

batteries that would have extremely long life, and be "as safe to carry as a house key." The Elgin National Watch Co. has actually demonstrated a tiny atomic cell, about the size of a cough drop, developed at the Walter Kidde Nuclear Laboratories, which Elgin proposes to adapt to power a wrist watch—its answer to Hamilton.

The dry-cell battery industry's answer to such dazzling new ideas is to keep on putting more and more power into smaller and smaller packages. The trend is such that it promises to make obsolete the ancient principle of spring-wound energy, and free the peripatetic American from his dependence on the electrical cord forever.

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How to Buy a Room Air Conditioner

[Continued from page 85]

new circuit for it, but the 115-volt line may be cheaper than a 230-volt line.

- 7 amp—230 volt—one horsepower. Capacity is highest of these four types, but you'll need a 230-volt line. This will cost more at first, but may be more economical in the long run since it gives you an extra electrical supply for other appliances.

Whatever kind of electrical service you choose, remember that you need an outlet that takes the three-prong grounded plug now standard on major appliances. You can install one easily in an existing box. And the outlet must be close to the window you're going to use. If you need an extension cord, get one from the air-conditioner dealer. Dime-store lamp extensions will *not* do.

What a conditioner does to your electric bill is not pleasant. Any unit uses up enough juice to operate a washing machine or electric heater—far more than a refrigerator. There's considerable variation from make to make (of the same type or cooling capacity). So the efficiency—the number of BTUs of cooling you get for a watt of electricity burned—is no minor matter.

Cabinet and installation. The newest models are remarkably compact, about 17 by 17 by 27 inches. But they usually cost more than the older bulky styles, which may be perfectly okay for you. Here's what to consider:

- Depth matters most if you object to a lot of metal hanging out your window. Some units, whether compact or not, can be mounted to put the box either entirely in, entirely out, or anywhere between. But none can be installed completely flush with both inside and outside walls of a frame house.

- Height reduces the light from the window. Check this, because some makers reduce depth by increasing height.

- Width is a consideration only if you must put a unit in a narrow window. Filler panels close up the space left over in wide windows. (Mitchell uses trans-

[Continued on page 241]

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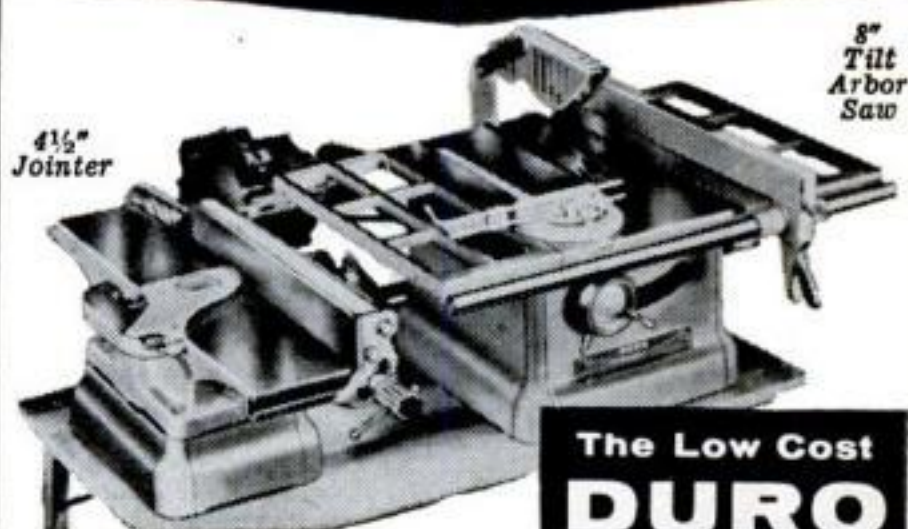
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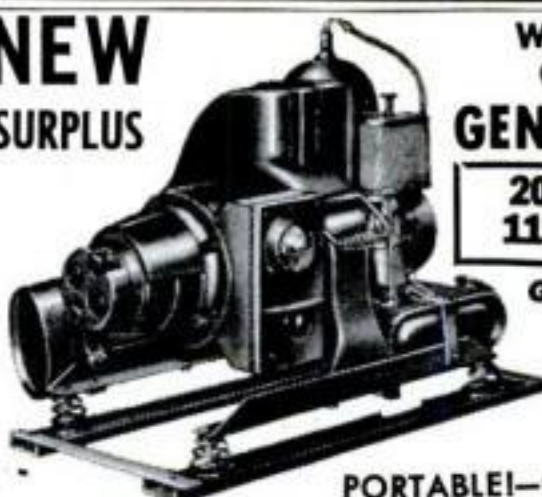
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do you act in each? Is susceptibility to hypnotism a sign of low intelligence? Can you be hypnotized without your knowledge or against your will? Can you be made to commit dangerous or immoral acts while in a trance or under post-hypnotic suggestion? Get all the answers in the full, straight-from-the-shoulder story in July POPULAR SCIENCE!

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How to stay alive over

July 4th weekend

The grim fact is that hundreds of us will die in auto accidents over the holiday weekend. Experts say that heavy traffic alone is not the cause. If the same number of cars were out on an ordinary working day, there'd be far fewer deaths. Why, then, do holidays kill us? For the revealing answer, see July POPULAR SCIENCE. Learn life-saving rules—besides the regular cautions against speeding, alcohol, mechanical failure. Learn how to eat and dress in order to avoid drowsiness. See how to prepare your tires to equalize the tilt from a heavy load in the rear seat and trunk. Discover a few tricks for handling restless kids. All this valuable data, and plenty more, is waiting for you in July POPULAR SCIENCE!

Get July Popular Science—at all newsstands, soon!

How to Buy a Room Air Conditioner

[Continued from page 238]

parent panels to avoid blocking light.)

Many units have louvers enclosing the condenser (out in the back). These not only keep rain out, but also shade the condenser from the sun.

The actual job of putting the machine in your window is straightforward, but don't expect to toss it off in an hour or two after supper. Here's why:

- The unit is heavy, 150 to 200 pounds. You'll need help to horse it into place.

- The mounting brackets must be screwed to a sound, solid window frame. In an old house, you may need a new sill.

- You have to drive the right screws at the right stage of assembly. Louse this up and you'll waste a lot of time and work. (All units come with reasonably clear mounting instructions.)

You can look for progress in ease of installation as manufacturers develop simpler mounting rigs. One step in this direction is Philco's Model A882-2, just now coming on the market. It weighs only 120 pounds, and is said to be very simple to install.

END

How Much Cooling Capacity Do You Need?

ITEM	Multiply By	Cooling Load
1. Area of windows facing:		
a. East, southeast or south:sq. ft.	45	
b. Southwest:sq. ft.	65	
c. West:sq. ft.	100	
d. Northwest:sq. ft.	35	
Compute cooling load for each exposure, but use only largest load here:	
2. Area of all windows not included in Item 1:sq. ft.	14
3. Length of walls:		
a. Facing same exposure used in Item 1:ft.	50
b. All other walls and partitions:ft.	30
4. Area of ceiling:sq. ft.	10
5. Area of floor:sq. ft.	3
6. Number of people using room:people	900
7. Wattage of lights and electrical equipment in use in room:watts	3
Total of separate cooling loads is cooling capacity in BTUs of air conditioner required:	

FILL IN BLANKS above to get total cooling capacity you require. Compare this figure with capacities of air conditioners (chart p. 84).

Superior's New Streamlined Model TD-55

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How to Climb a Mountain from Inside

[Continued from page 70]

there was a farmhouse. One of our party told the farmer where we were bound.

That, we learned, is an elementary precaution when you go "spelunking." You never enter a cave without telling somebody about it. You might want people to know where to look for you.

We left word twice more, to be on the safe side. First, Gene wrote a message on a piece of cardboard, which he then stuck on the windshield of his car after we had climbed out to hike the last half-

.....

Money still talks, of course, but it has to stop and catch its breath more often these days.

—THE SIDEWALK SUPERINTENDENT

.....

mile or so through the woods. Later, after we reached the site, someone hoisted a red flannel shirt. This signal meant that a party was inside the cave.

What were we getting into? The cave entrance was both disappointing and rather frightening. Instead of stately pillars of rock flanking a majestic archway, there was a sinkhole—a steep-walled, muddy gulch 30 feet below the forest floor. Into it plunged a picturesque waterfall, but the falls didn't stop there. It dropped right on through a three-by-four-foot crack at the bottom of the sinkhole. *And that crack was the entrance to the cave!*

It was too late for second thoughts. Peter Van Note, second-in-command, was tying a rope to a tree. The rope was to guide us down the sinkhole and beyond. There was a roll call—nobody would be forgotten in the cave.

Then we started sliding down the muddy slope. It was hand-over-hand along the rope down to a slab of rock that formed a kind of threshold.

The rock wobbled. One good, hard kick would send it right into the crack, which it would seal quite efficiently, like a quarter-ton manhole cover.

This possibility was on my mind dur-

[Continued on page 244]



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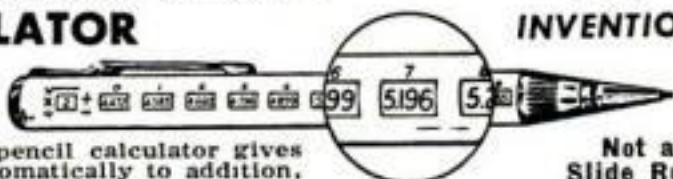
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How to Climb a Mountain from Inside

[Continued from page 242]

ing the astonishing moment when my arms and head were still in the world I knew and the rest of my body wasn't. I was entering another world.

That is, I was trying to. Dangling over dark space, I groped for a foothold. Then my feet touched something solid—the first slippery rung of a natural rock ladder, on which three out of every four rungs seemed to be missing.

There was a small, sloping, boulder-strewn platform 15 feet below the entrance, a passage leading away and around a bend, and then the cave had us.

We stumbled over boulders and slogged through pools, awed by the eerie,

One of the easiest ways to meet your neighbors is to own the best tool shed in the block.

—THE SIDEWALK SUPERINTENDENT

fascinating rock scenery, sprayed by underground waterfalls.

Suddenly, when I happened to be alone in one of the passageways, my carbide lamp gave out. Instantly I was in total darkness that bore little relation to a night without moon and stars.

A few weeks before, Burton Faust, veteran cave explorer and treasurer of the NSS, had described the effect of darkness in a cave:

"No one who hasn't experienced it before can understand it. You put your hand in front of your face, and a minute later you don't know the hand is there. And when the cave is quiet, you hear your own heart. It sounds like someone running down a cave corridor. Your breathing sounds like wind."

I was immensely grateful for the flashlight, which I snapped on to see my hands again and to find the end of the passage that led to the so-called attic.

Here was a chamber with a sloping, bat-studded ceiling. The bats, hanging head down, seemed tiny—hardly bigger than large, brown butterflies.

[Continued on page 247]



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How to Climb a Mountain from Inside

[Continued from page 244]

There was a deep, round well on one side of the "attic," leading to a brook about 10 feet below. Beyond it lay the narrowest of passageways. A Boy Scout in our party tried to squeeze through; he couldn't, because the ceiling almost met the floor. Yet, for all we knew, an enormous maze might begin right where we thought the old cave ended. We were tantalized by the unsolvable mystery.

Leaning against the dripping walls of the attic, watching the bats stir in their

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sleep and clouds of cigarette smoke drift past carbide lamps, everybody looked relaxed—but the novices couldn't quite hide their excitement over this utterly new adventure.

When we later emerged into the bright forest above, somebody noticed a darkish spot near a birch grove.

It looked like another sinkhole. Some of us were keen to investigate.

We asked Gene Vehslage if he thought it led to a new cave.

"Could be, could be," he said. "But you know the rules. If you find a cave, turn around. Go home and come back with two friends. Better make it three. Then if you get hurt, one of them can stay with you while the other two try to get help."

We decided to leave further exploring to another day.

END



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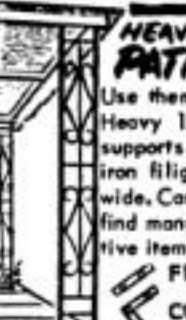
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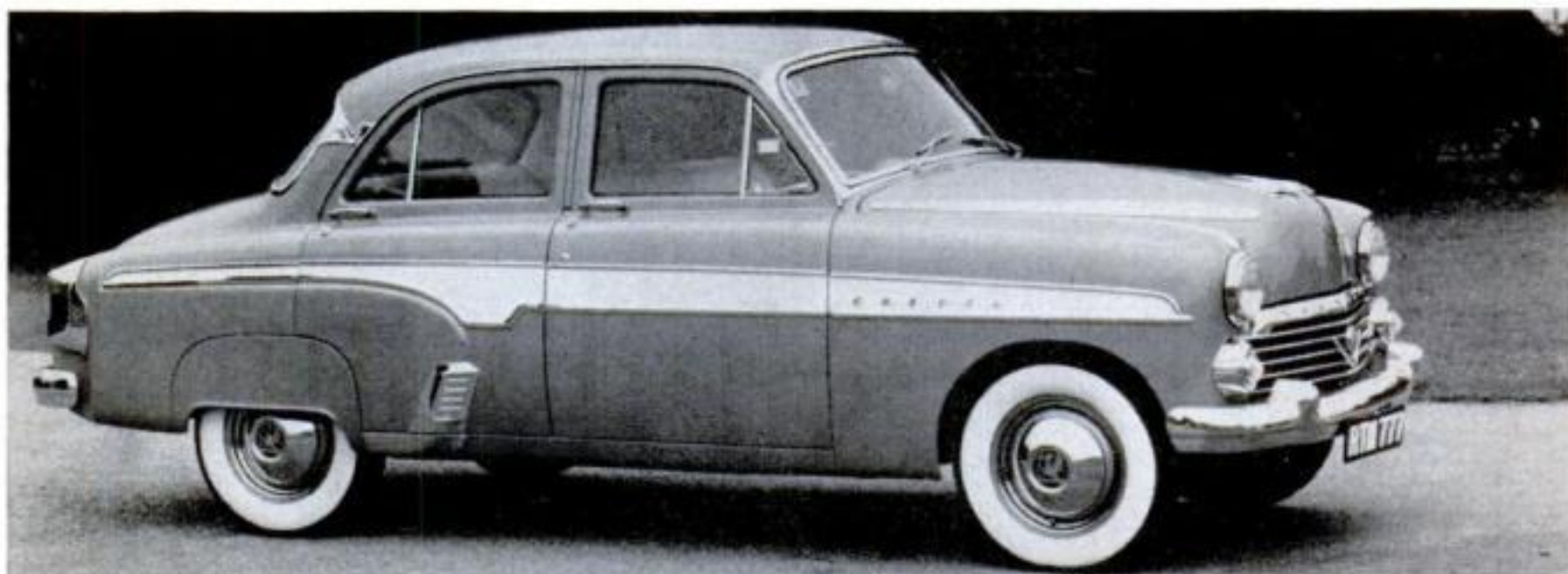
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Mercedes 300SL Gets Roadster Brother

THIS sporty soft-top by Mercedes-Benz sticks closely to the mechanical specs of the 300SL coupe, the car known for its gull-wing doors. Like its sports-racing elder brother, the roadster comes with a six-cylinder, fuel-injected engine.



Conservative British Try a Spot of Color

THE Vauxhall Cresta drops restraint for flashier paint. An optional high-compression head adapts the engine for 100-octane fuel—new to Britain.

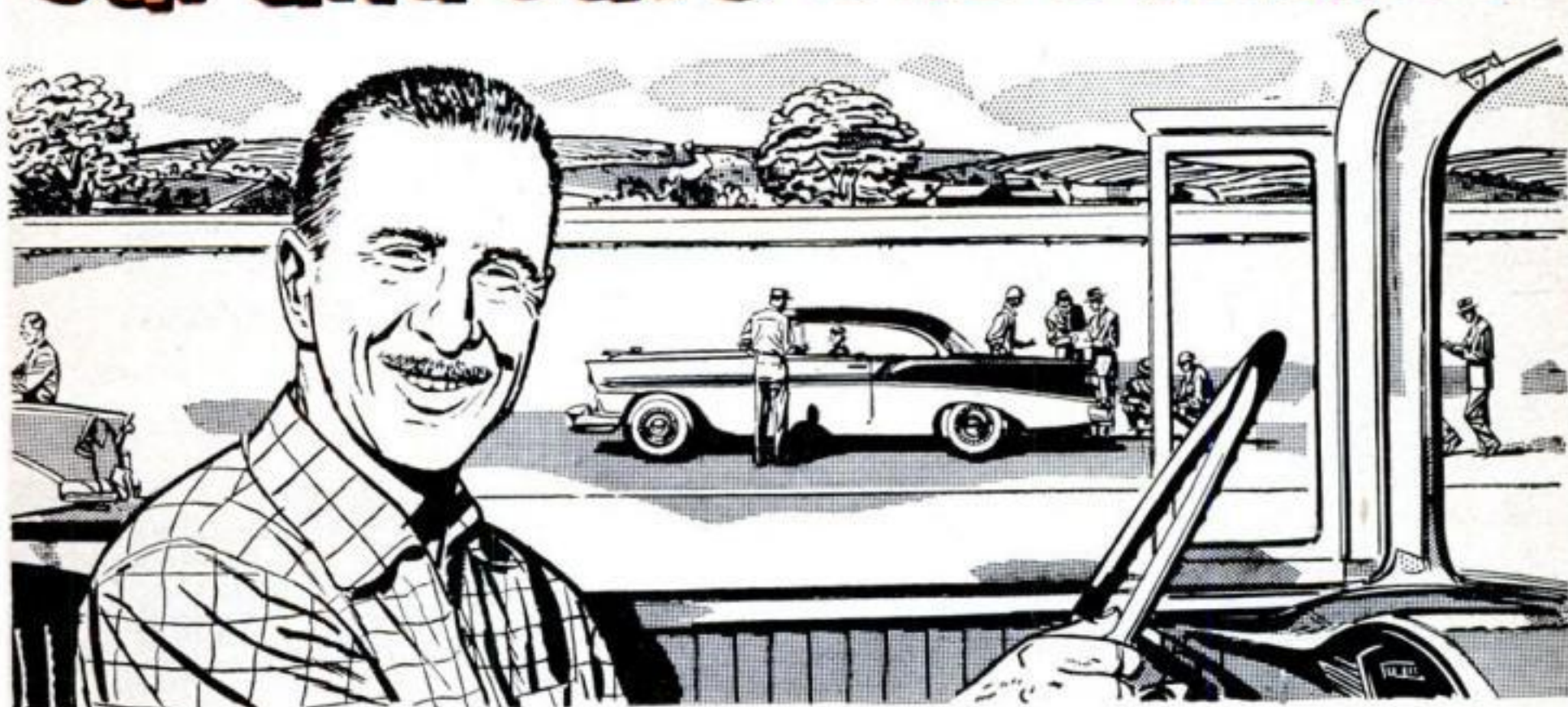
Information for Signaling Subsystem

This One



GFBY-Y95-J850

"How to Think Ahead of Your Car and Save Gas Dollars!"



"Professional drivers think ahead of their cars... avoid needless stops and starts... save fuel that many drivers waste..."

Mauri Rose

One of America's top professional drivers for over 25 years, three-time Indianapolis 500-mile winner.



"Most drivers waste gas at stop lights. The smart driver goes at a steady pace, slowing down well back of a red light... avoiding the stop if possible."



"A professional driver always keeps well back of the car ahead. This way, he avoids gas-consuming 'panic' stops... possible rear-end collisions."



"A pro never speeds over a hill or into any 'blind' situation. It's dangerous... and even if you can stop in time, it's a stop and start that consumes extra gas."

You can think ahead of your car in more ways than one. Make sure you're getting all the performance you paid for... see your Rochester Carburetor specialist. He'll give your car the kind of care that only a factory-trained mechanic can. And he knows that Rochester Carburetors are precision-built for top performance on today's high-compression engines... they're rugged and reliable! They'll help you save on gas by delivering just the right mixture, at just the right time, to squeeze extra mileage out of every gallon.

Standard equipment on Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet

R ROCHESTER CARBURETORS

ROCHESTER PRODUCTS DIVISION
GENERAL MOTORS CORP., ROCHESTER, N. Y.



"A stop every good driver considers necessary is at his factory-trained mechanic's for regular checks on the carburetor and vital engine parts whose condition affects performance and economy."



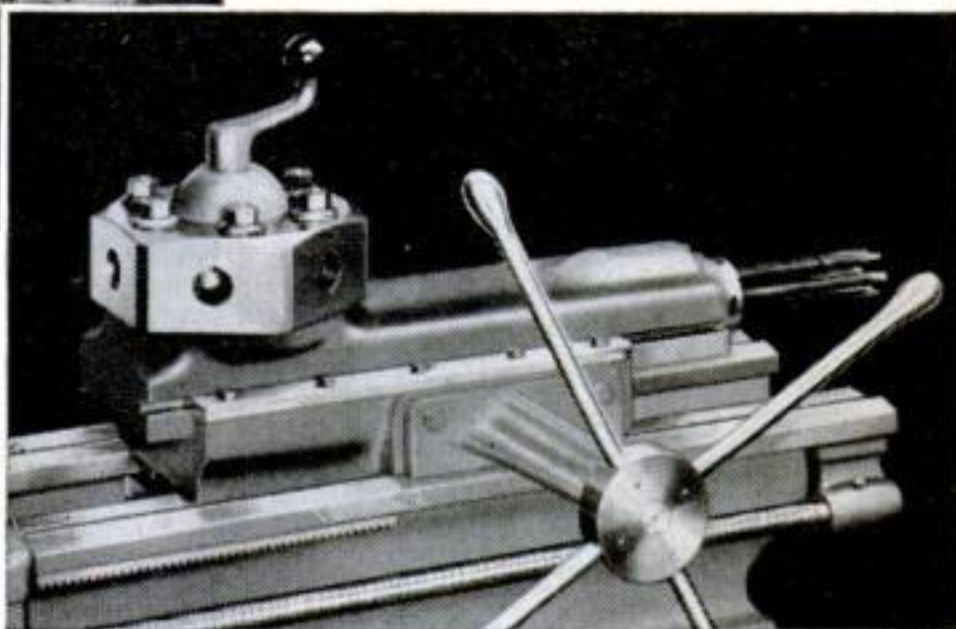
KEEP CLOSE-TOLERANCE MACHINING EFFICIENT!

South Bend PRECISION TURRET LATHES

South Bend 2-H Precision Turret Lathe—1" collet capacity, 16 $\frac{1}{4}$ " swing, 96 power turret feeds, 48 cross slide feeds, 48 carriage feeds, 48 thread cutting feeds.

Base Price \$3484

South Bend Precision Turret Lathes keep efficient the machining of small duplicate parts. Their remarkable accuracy and positive controls simplify the holding of close tolerances with only normal machine handling care. Finishes are commonly produced that otherwise would require additional operations. Simplicity of tooling makes job changes quick and economical. Wide ranges of power feeds and thread cutting feeds assure maximum efficiency on every job. They are particularly suited for second operations. Sizes available include: 1" collet—16" swing; 1" collet—13" swing; 1" collet—10" swing. Priced from \$1665.



TURRET ATTACHMENTS

South Bend Turret Attachments are available for tooling 9", 10", 13" and 16" swing South Bend Lathes for repetitive operations. Precision built for precision work, their rigidity and accuracy permit maximum feeds and speeds. Prices of hexagon bed turrets range from \$284.00 to \$726.00. Square Turret Tool Blocks are priced from \$43.25 to \$94.50. Write for Catalog giving full information on South Bend Turrets and the complete line of South Bend Attachments and Accessories.



PLEASE SEND INFORMATION CHECKED:



☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES



☐ DRILL PRESSES



☐ $\frac{1}{2}$ " & 1" Collet TURRET LATHES



☐ TOOL GRINDERS



☐ 7" BENCH SHAPERS



☐ MILLING MACHINES

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City _____ State _____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

BURIED ALIVE!



SIX YEARS ON THE SAME JOB WITH NEVER AN ACCIDENT...
AND THEN ONE MORNING...

A CAVE-IN PUT ME SIX FEET
UNDER FOR SIX LONG MINUTES

QUICK! GET
HIM OUT OF
THERE!



I'D PASSED OVER DOZENS OF
I.C.S. ADS IN POPULAR
SCIENCE. BUT I SAW THIS
ONE IN A NEW LIGHT



HOW'S IT
GOING,
DARLING?

FAST! I'M INTO
HYDRAULICS ALREADY.
AND I THOUGHT I
WAS TOO
OLD TO
LEARN



SIGNING UP FOR THAT I.C.S.
COURSE WAS THE SMARTEST
THING I EVER DID

ONE MONTH LATER...

GOOD TO SEE
YOU BACK ON YOUR FEET, JIM. IT'LL
BE AWHILE BEFORE YOU'RE BACK IN THE
FIELD. SO WE'LL FIX A TEMPORARY
DESK FOR YOU IN THE OFFICE
WHEN YOU'RE
READY



THEY GAVE ME SOME SIMPLE
ASSIGNMENTS... AND I SURE
SURPRISED THEM!



THEN A FEW DAYS LATER,
MR. WALSH CALLED ME IN...



HERE'S WHERE YOU COME IN! LET I.C.S. SHOW YOU THE WAY TO
MORE PAY, RAPID ADVANCEMENT, REAL JOB SECURITY!
MAIL THIS COUPON TODAY!

THAT EVENING, JANE AND I
WENT HOUSE HUNTING



HAVE A REAL CIGARETTE— HAVE A Camel

"I want a real cigarette... no fads or fancy stuff. That's why it's Camels for me. They taste good all the time — never let you down."

Paul O'Shea

Sports Car Driver and
Consultant Engineer



R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

**Discover the difference
between "just smoking" ... and Camels!**

Taste the difference! You'll find that Camels taste rich, full-flavored, and deeply satisfying—pack after pack.

Feel the difference! The exclusive Camel blend of quality tobaccos has never been equalled for *smooth* smoking.

Enjoy the difference! More people today smoke Camels than any other cigarette. Try Camels—they've really got it!

America's real smoke is **Camel**—the largest-selling cigarette today!